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INTEGRATED WEED MANAGEMENT

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Final Report
for
Integrated Weed Management

Garry Bowes

Coordinator

Noxious Weed Program

3830 Thatcher Avenue

Saskatoon, SK

S7K 2H6

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6. Bowes, G. 2004. Good Record Keeping is a Necessity - For this generation and the next! Rural Councillor. June/July Vol. 39 (3). 10
7. Bowes, G. 2004. Chilly Reception for Biological Control Agents. Crop Production News, July 2004. 12
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Integrated Weed Management 20020266

(a) Abstract

Scentless chamomile seed weevils (*Omphalapion hookeri*) and gall midges (*Rhopalomyia tripleurospermi*), and leafy spurge flea beetles (*Aphthona cyparissiae, A. nigriscutis and A.* lacertosa) are establishing. Seed weevils and gall midges move around fairly well. Beetles should be moved from an established site to new sites. Seed weevils and gall midges should be released in large areas with scentless chamomile on a site where weed spread is unlikely. The agents will attack scentless chamomile that is not controlled by a mower or herbicide. Use beetles to control large areas with leafy spurge that are contained by a herbicide. Details were delivered on how to use integrated weed control to stop these weeds from spreading along roadsides.

(b) Technical Report

Objectives

- to collect data and document the success of biocontrol agents released in Saskatchewan by evaluating:
    - existing colonies of biocontrol agents released for the control of persistent perennial weeds, including scentless chamomile and leafy spurge,
    - the long-term benefit of integrating biological control agents with existing control options such as herbicides for scentless chamomile and leafy spurge,
    - existing biocontrol release sites on scentless chamomile to determine the 'best fit' for biocontrol when integrated with mechanical and herbicide control methods, and
    - to develop and implement provincial **awareness** for the use of biocontrol agents in an integrated control program to **stop** the spread of scentless chamomile, leafy spurge and other perennial weeds.
- to ensure that Saskatchewan has access to new biocontrol related technology including classical, inundative and molecular agents and products and to evaluate and release additional biocontrol agents as they become available.

MILESTONES

BIOCONTROL - Persistent Perennial Weeds & Scentless Chamomile Program Awareness

1. Prepare progress report

Progress reports outlined the achievements for the various milestones that were listed for the project.

Documents that supported the milestones referred to in the progress reports are presented in Appendixes 1 to 7. This information was organized into;

- print articles (Appendix 1 Pages 1 - 18);
- information presented in booths at conventions and training clinics (Appendix 2 Pages 1 - 70);
- handouts at field days (Appendix 3 Pages 1 - 5);
- PowerPoint presentations to landowners, Reeves, Councillors and Weed Inspectors (Appendix 4 Pages 1 - 43);
- reports to professional agricultural organizations (Appendix 5 Pages 1 - 6);
- libraries of slides of past PowerPoint presentations (Appendix 6 Pages 1 - 24); and
- bulletins and reports with technical information (Appendix 7 Pages 1 - 152).

2. Schedule of biocontrol site inspections

The schedule for biocontrol site inspection during 2003 was selected from the 2002 Scentless Chamomile Biological Control Agent Information Guide and the 2002 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide, which documented all known release sites in the province. Sites selected were those that were thought to have the best potential for agent collection and redistribution.

The schedule for biocontrol site inspection during 2004 was selected from the 2003 Scentless Chamomile Biological Control Agent Information Guide and the 2003 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide. Sites selected were those that were thought to have the best potential for agent collection and redistribution. In 2004, priority was given to sites that were monitored in 2002 and 2003 to see if there is a change in agent number from year to year.

3. Conduct biocontrol site inspections

During the summer of 2003, 40 scentless chamomile seed weevil (*Omphalapion hookeri*) release sites were monitored for the weevils, 23 scentless chamomile gall midge (*Rhopalomyia tripleurospermi*) release sites were monitored for the gall midges and 107 leafy spurge flea beetle (*Aphthona cyparissiae, A. nigriscutis and A. lacertosa*) release sites were monitored for the presence of the beetles.

During the summer of 2004, 34 scentless chamomile seed weevil release sites were monitored, 21 scentless chamomile gall midge release sites were monitored and 97 leafy spurge flea beetle release sites were monitored.

The total number of monitored sites during 2003 and 2004 for leafy spurge flea beetles were 204, scentless chamomile seed weevils were 74 and gall midges were 44. The grand total was 322.

4. Establish mother colonies of new biocontrol agents

In cooperation with landowners and Weed Inspectors during 2003, 15,000 leafy spurge flea beetles were collected at the Last Mountain House Historic Park site and released at 8 new locations near Silton and Outlook. During 2004, 40,000 – 50,000 leafy spurge flea beetles were collected from the Maxim site and released in the Milestone and Moose Jaw areas.

Seed heads were collected from scentless chamomile plants in 2003 and released in five sites at an abandoned gravel pit near Wynyard. Old gravel pits are thought to be among the best sites to establish ‘mother colonies’.

During 2004, a sufficient number of scentless chamomile plants with galls were collected from the Canwood area for 5 releases in the City of Yorkton. Staff from the Parks Department was trained on how to collect and release gall midges.

In 1996, seed weevils were released on scentless chamomile that was growing on a pile of top soil on the east side of the City of Yorkton. Between 1996 and 2004 the seed weevils moved from the east to the west side of the city. The intent is for Yorkton to be a major collection site for both agents. At present, Yorkton is a good collection site for seed weevils.

5. Consultative services to rural municipalities

Information was sent to rural municipalities in response to inquiries.

A meeting on the mapping of weeds was called on January 12, 2004 and held in Watrous. In attendance was the Weed Inspector, members of District 43 ADD Board and Nancy Gray, Extension Agrologist. Technical information and suggested names of experts for mapping was given to those attending the meeting. The purpose of the meeting was to include weed mapping methods in a display in a future Information Booth. District 43 ADD Board developed a mapping procedure for noxious weeds. Information on how the mapping procedure works was presented at SARM (Saskatchewan Association of Rural

Municipalities) Convention 2004 and WITCs (Weed Inspector Training Clinics) 2004 (Appendix 2 Pages 54 - 55).

6. Monitor biocontrol sites for the 'best fit' of agents

While the scentless chamomile seed weevils consume some of the seed that is produced by the weed, some seed is produced and available to help the weed spread to new locations. Therefore, the best use of the weevils is with other control methods. Weevils should be released at a secure location on sites where scentless chamomile grows over a large area and the weed is controlled by herbicides or mowing. The weevils will find scentless chamomile plants that are missed by herbicide or mowing treatments. When small patches of the scentless chamomile are found the best treatment is the repeated use of a herbicide as required to control the weed.

Eleven seed weevil releases that were made during 1995 and 1996 in the Edenwold area were classed as problem sites because they were flooded or thought to be destroyed by human activities. After a 30 minute search during 2003, weevils were found on 9 of these release sites. On the regularly monitored sites, seed weevils were found on 16 of 18 sites. It is mathematically possible, but thought to be improbable in all cases, that the weevils may have moved from the regular monitored to the problem sites. Most released seed weevils establish.

The best fit for gall midges is unknown. The biocontrol agent changes the architecture of scentless chamomile and may reduce plant height (McClay 2003). It is not known if these changes in the structure of the weed are detrimental when there is competition from established grasses. Scentless chamomile plants that are induced to form galls by the midge produce ample seed. Gall midges should not be released on small patches of scentless chamomile because the weed will produce seed which will help it to spread to new sites.

Figure 1 Scentless chamomile growing along a fence line

Figure 2 A good site for the release of seed weevils and gall midges

Seed weevils and gall midges are often released along a fence line or in the corner of a field. Figure 1 shows scentless chamomile growing along a fence line. This is a site where seed weevils and gall midges should not be released and where the most appropriate control method is a herbicide. Seed weevils and gall midges will establish but the noxious weed will continue to set seed. When the field on the right in Figure 1 is harvested, seed can be transported with equipment. If the right-of-way is mowed on the left of Figure 1 then seed can be transported on the mower.

Figure 2 shows a site that is suitable for the release of seed weevils and gall midges provided there is no means for the spread of seed. Water is the most likely method for transporting seed. From this site the biological control agents can spread. According to research at the Alberta Research Council at Vegreville, seed weevils can travel 2.7 km/year and gall midges can travel 5.2 km/year (McClay 2003).

7. Develop methods for and distribute biocontrol agents

The best opportunity for the spread of biocontrol agents occurs when a 'champion' is found in a local area. A champion has an interest in biocontrol and once trained, a champion will independently promote the use of biocontrol agents for weeds.

In the fall of 2003, the City of Yorkton expressed an interested in the use of seed weevils and gall midges to suppress populations of scentless chamomile. During the spring of 2004, staff from the Parks Department was trained on how to collect and release biocontrol agents, and to select the most appropriate release sites.

During 2003, a landowner from Silton and a Weed Inspector from the Outlook area were trained on how to collect leafy spurge flea beetles, pick appropriate release sites and release the beetles on those sites. These collectors were encouraged to make multiple collections each year. 15,000 leafy spurge beetles were collected at the Last Mountain House Historic Park site and released at 8 new locations near Silton and Outlook.

In 2004, a presentation was made at a field day at Last Mountain House Historic Park on April 27th. The title of the presentation was; Leafy Spurge Beetle Collection in Saskatchewan. Seven individuals representing three municipalities were trained on how to collect and release leafy spurge flea beetles. The purpose of the early season meeting was to train the collectors on how to monitor beetles population so they could collect on a day when beetle numbers were high. Leafy spurge flea beetles often appear during the first week in July and high numbers are present thereafter during hot weather. Because of the cooler weather in 2004 than 2003, the beetles appear 2 – 3 weeks later. Monitoring in July revealed that Last Mountain House Historic Park was a good collection site in 2003 and a poor collection site in 2004. In 2004, monitoring confirmed that Maxim was a good collection site. This resulted in the collection of 40,000 – 50,000 beetles from the Maxim site and released in the Milestone and Moose Jaw areas.

The field day at Last Mountain House Historic Park pointed out the need for a good handout on how to collect and release leafy spurge flea beetles. During the summer of 2004 photos were collected for all of the equipment and actions that are needed for a bulletin. The title of the bulletin is:

- Where, When and How to Collect and Release Leafy Spurge Flea Beetles, 6pp (Appendix 7 Pages 10 - 15).

This bulletin was handed out at the SARM Midterm Convention 2004 and will be handed out at the SARM Convention 2005, and WITCs 2005.

Because there is no information on how to collect and release scentless chamomile seed weevils and gall midges, similar photo-bulletins were prepared for these biocontrol agents. The titles of the bulletins are:

- Where, When and How to Collect and Release Scentless Chamomile Seed Weevils, 6pp (Appendix 7 Pages 16 - 21) and
- Where, When and How to Collect and Release Scentless Chamomile Gall Midges, 5pp (Appendix 7 Pages 22 - 26).

8. Show how biocontrol fits into integrated weed control

The appropriate place for biocontrol agents for scentless chamomile in an integrated weed control program was demonstrated in a television interview for the general public. The television interview (CTV) on July 7, 2003 took place in the field near Canwood with Brian Harris (Extension Agrologist) and Lawrence Kvinlaug (producer). The interview was requested by Bob Simpson, CFQC news.

Scentless chamomile seed weevils and gall midges, and the leafy spurge flea beetles have a long term effect on their specific weed but the effect is different for each agent. Each agent has a place in Integrated Weed Control.

Integrated Weed Control is the use of a combination of non-conflicting methods to control weeds. The methods can be side-by-side or stacked one method on another method. There are four control methods and they are; Physical, Chemical, Biological and Ecological. Physical control is pulling weeds manually or mechanical by mowing. Chemical control is using a herbicide to control or kill. Biological (Classical) control is using an insect to suppress a weed population. Ecological control uses plants to aggressively compete with weeds or animals to graze weeds.

To survive, the scentless chamomile seed weevil must be able to complete its life cycle, each year, on the weed. One generation of seed weevils is produced per year. The long term benefit of the seed weevil is the yearly consumption of a portion of seed that the scentless chamomile produces. One weevil consumes about 11 seeds (McClay and De Clerck-Floate 1999) and based on a single plant, about 40% of the seed were consumed. Seed consumption in the seed weevil's native home in Europe is reported to be about 35% (Peschken et al. 1989). Maximum benefits occur when the seed weevil finds a scentless chamomile plant growing on rock piles or along a waterway (Figure 2). Scentless chamomile plants on these sites are almost impossible to control except manual pulling, which is difficult because to prevent seed drop, all weeds must be found. The affect the seed weevil has on stopping the overall spread of the scentless chamomile is unknown.

The gall midge produces 2 and perhaps 3 generations in a year. The midge induces the formation of galls on the growing points of scentless chamomile plants. In the spring, galls are most often found on bolting stems. In the fall, galls are found on rosettes next to

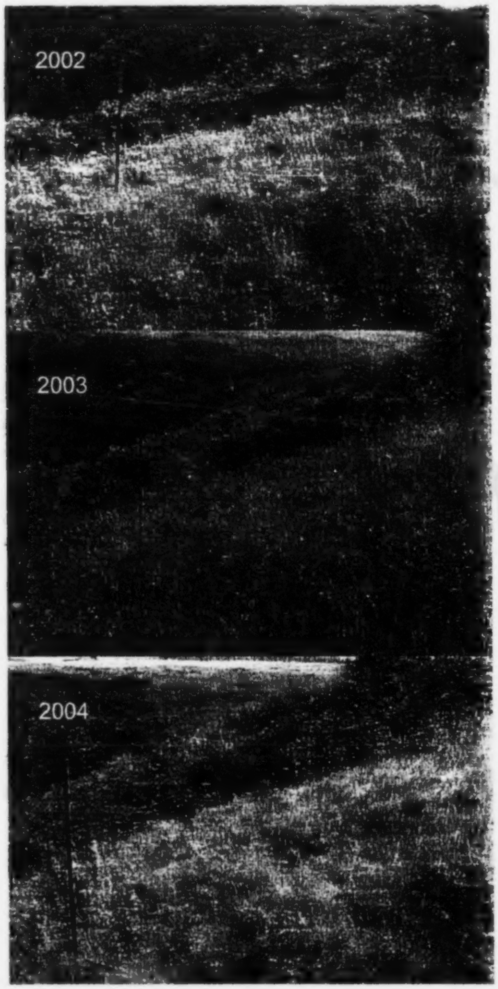


Figure 3 A series of photographs taken in 2002, 2003 and 2004 show the reduction in leafy spurge following the release of black flea beetles in 1996

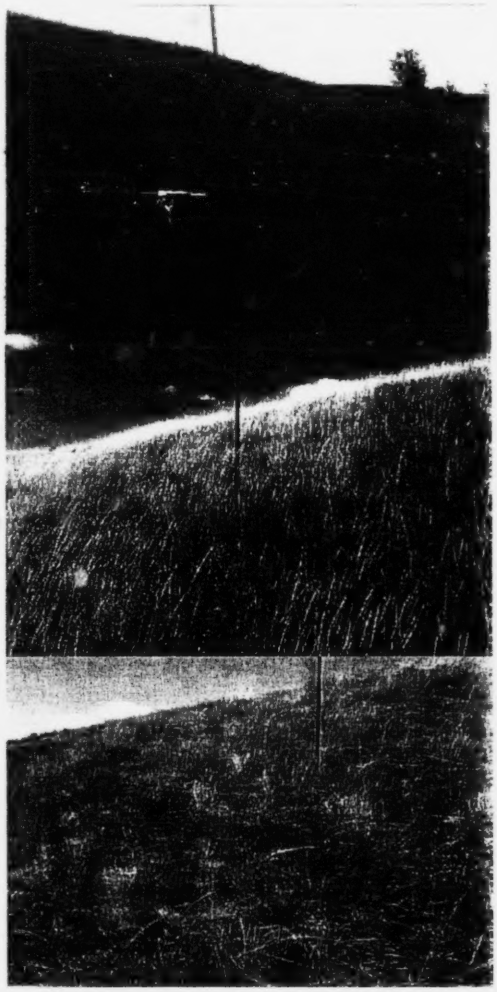


Figure 4 A series of photographs of a release site show that leafy spurge was not present in 2002 and 2003 but was present in 2004 following the release of black beetles in 1996

the soil surface. It is thought that gall formation diverts some energy from the plant to the gall. The benefit of the gall midge is a sometime reduction in plant height (McClay 2003). The impact that height reduction has on the plant is unknown.

Gall midges were released in Canada in 1999. Before the damage that gall midges cause on scentless chamomile can be assessed, the population must increase and be in equilibrium with the weed. In the fall of 2002, grasshoppers ate galls on rosettes at some of the release sites. During 2003 and 2004 galls were not found at these sites. At most sites, galls were found on some plants. No quantitative count was recorded for the portion of plants attacked by the gall midge but it is low. The long term benefit is unknown.

Leafy spurge flea beetles damage the weed by eating the roots. The long term benefit of the beetles is a reduction in the cover of leafy spurge on the soil surface but some leafy spurge may be present (Figure 3). Leafy spurge was present on the site in 2002. During 2003 leafy spurge stems were present but a flower appeared on only a few of the stems. In 2004, only a few flowering stems were present at the release site.

Near the site where the photographs in Figure 3 were taken, leafy spurge appeared on a site where the weed was previously controlled by beetles (Figure 4). During 2000, three black dot beetles were found at the site. Close inspection found two plants, 5 and 8 cm tall. Leafy spurge was not found on the site in 2002 or 2003 but was present in 2004. This degree of control is consistence with biocontrol theory. The weed and the biocontrol agent are present in equilibrium.

The long term benefit of leafy spurge flea beetles varies with the release site (Table 1). During the summer of 2003, beetle release sites were monitored and the performance of leafy spurge beetles was assessed for the suppression of the noxious weed.

Table 1 Ground cover of leafy spurge on beetle release sites

Years After Release	Leafy Spurge Cover (%)	Percent Grazing Loss	Number of Beetles/Sweep	Percent of Samples
2 – 16	0	0	1	5
2 – 16	1 – 10	4	4	17
2 – 16	15	10	10	12
2 – 16	20	8	8	10
2 – 16	21 – 40	7	7	26
2 – 16	41 - 100	5	5	31

Brown dot, black dot and/or black leafy spurge flea beetles were release 2 to 16 years before monitoring during 2003 (Table 1). Sites were not differentiated by species because one or more species were often found at some sites. There was a tendency to release brown dot at a site and then a year or two later black dot flea beetles were released. When black flea beetles became available in the 1990's, they were often released near a previous release site. At many collection sites a mixture of black dot and black flea beetles are often found.

At each site, an area was subjectively selected around the release point. Suppression of leafy spurge was estimated as percent canopy cover of leafy spurge on the soil surface. Sites were averaged over 2 to 16 years after release for subjectively selected cover classes of 0, 1 to 10, 15, 20, 21 to 40, and 41 to 100 percent canopy cover by leafy spurge of the soil surface. Year of release was difficult to document because at some sites several releases were made over several years. Cover classes were subjectively selected because some producers are willing to accept 10% cover of the soil surface by leafy spurge whereas other producers will reluctantly accept 15%.

The population of beetles was measured by estimating the number of adults per sweep, using a 38 cm sweep net.

The cover of leafy spurge was related to cattle grazing loss using North Dakota data (Figure 5, Leitch et al. 1994). In the graph shown in Figure 5, leafy spurge reduces carrying capacity by direct competition and the barrier effect. Leafy spurge dominates grass stands. Cattle partially or totally avoid forage that grows near leafy spurge. The relationship between lost grazing and amount of leafy spurge infestation is approximated by:

$$RCC = CC * [1 - (1.25 * PI/100)]$$

where

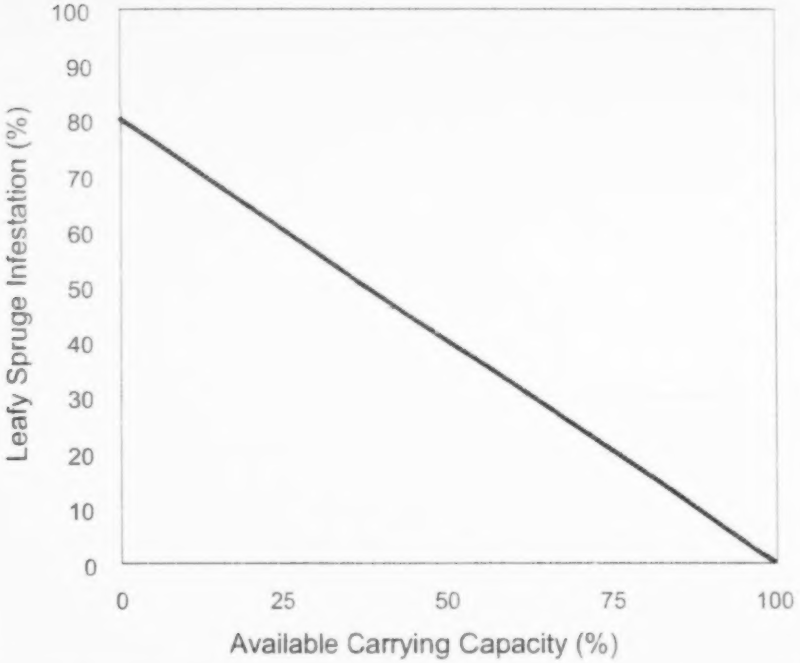
RCC = reduced carrying capacity (AUMs/acre),
CC = normal carrying capacity (AUMs/acre) and
PI = level of infestation expressed as a percent of land cover by leafy spurge.

All of the monitored sites were known to have established beetles. The number of sites were beetles were released and failed to establish is unknown.

Leafy spurge beetles are suppressing leafy spurge but the degree of suppression is not sufficient to meet the expectation of land occupiers. On 5% of the release sites, there was no leafy spurge (Table 1). On 17% of the release sites, leafy spurge covered 1 to 10% of the soil surface, which caused a 1 to 13% loss of grazing by cattle (Table 1 and Figure 5). Assuming that producers may accept leafy spurge covering up to 15% of the soil surface, then only one-third (5% + 17% + 12%) of the release site gave satisfactory control. At 15% leafy spurge cover the grazing loss would be 19% of the available carrying capacity.

Producers are more likely to accept 10% cover of leafy spurge with a grazing loss of 13%. Twenty-two percent of the sites monitored had 10% or less cover of leafy spurge.

Figure 5 Reduced Carrying Capacity



9. Review extension materials, revise or develop as necessary

Landowners and Weed Inspectors ask about weeds that grow on a few acres in the province or are found in neighbouring provinces and/or states. In consultation with Clark Brenzil, Provincial Weed Control Specialist, a list of 6 weeds was compiled. The weeds are common crupina (*Crupina vulgaris*), field bindweed (*Convolvulus arvensis*), spotted knapweed (*Centaurea maculosa*), wild parsnip (*Pastinaca sativa*), yellow starthistle (*Centaurea solstitialis*) and yellow toadflax (*Linaria vulgaris*). Information on these plants was collected and combined with photos, and printed in an awareness leaflet format. These leaflets were shown to Reeves, Councillors and landowners at the WITCs 2003 (Appendix 2 Pages 1 - 6). The list was subsequently expanded to 9. Following a review of extension material from neighbouring provinces and states, a series of 9 awareness leaflets was prepared.

At the SCWG (Scentless Chamomile Working Group) meeting in November 2003, attendees suggested that the awareness leaflets be reformatted, printed and given to landowners, municipal officials and Weed Inspectors. The awareness leaflets were reformatted and placed into three categories, which are weeds that:

1) are not known to grow in Saskatchewan;
    Common Crupina (*Crupina vulgaris*) and
    Yellow Starthistle (*Centaurea solstitialis*),

2) grow on a few isolated areas in the province;
    Hoary Alyssum (*Berteroa incana*),
    Spotted Knapweed (*Centaurea maculosa*) and
    Wild Parsnip (*Pastinaca sativa*) or

3) grow on many isolated areas in the province;
    Common Tansy (*Tanacetum vulgare*),
    Field Bindweed (*Convolvulus arvensis*),
    Leafy Spurge (*Euphorbia esula*) and
    Yellow Toadflax (*Linaria vulgaris*).

These awareness leaflets were designed with minimal text to provide the most important information on identification, harm to agriculture and known locations. The awareness leaflets were shown as part of an Information Booth, which was shown at the SARM Convention 2004 and the WITCs 2004 (Appendix 2 Pages 35 - 46).

Three Wanted Dead to Prevent Spread posters were prepared for:
    Field Bindweed,
    Leafy Spurge and
    Yellow Toadflax.

These leaflets were designed as posters similar to the successful design that was used for scentless chamomile. Weed Inspectors can place these posters on billboards in public places. The Wanted Dead to Prevent Spread posters were shown as part of an Information Booth, which was shown at the SARM Convention 2004 and the WITCs 2004 (Appendix 2 Pages 47 - 50).

Twenty-four articles that were authored by Garry Bowes and published in the Rural Councillor were scanned and saved as pdf files. These articles are available from the author on request and are available on a server that is common to SAFRR staff. This activity was requested by attendees at the 2003 SCWG meeting.

A questionnaire for a North American internet survey to be conducted by the USDA to evaluate the biological control program for purple loosestrife was evaluated. Subsequently, the survey was pulled from the internet for unknown reasons.

An article outlining the lateness of biocontrol agents for the control of scentless chamomile and leafy spurge was prepared and submitted to Crop Protection News (Appendix 1 Pages 12 - 13). The title of the article was: Chilly Reception for Biological

Control Agents. This article updated agrologists during the growing season on biocontrol agents.

A new bulletin on how to control leafy spurge was prepared and submitted for posting on SAFRR's web site. The title of the bulletin is: Leafy Spurge Control (Appendix 7 Pages 1 - 9).

In response to questions on leafy spurge by Weed Inspectors, an up-to-date literature search was completed. Relevant information from research papers was summarized and presented in an Information Booth at SARM Midterm Convention 2004 (Appendix 2 Pages 57 - 63). Data presented in part of the Information Booth was:

1) Will Viable Seed of Leafy Spurge Pass Through the Digestive Tract of Sheep?,
2) Recovery of Leafy Spurge Seed from Sheep,
3) Leafy Spurge Suppression with Flea Beetles and
4) Biological Control of Leafy Spurge with Beetles.

10. Presentations to workshops, clinics, farmer meetings

Nine PowerPoint presentations were made to various organizations (Appendix 4 Pages 1 – 43). The contents of the presentations were designed to fill requests for information. Included in the presentations were the need for awareness, education and control.

1. Noxious Weed Control Update was presented to the staff of Ducks Unlimited Canada in Regina (Appendix 4 Pages 1 - 11). The content of the presentation was similar to what was given to Weed Inspectors at their training session. Ducks Unlimited Staff are aware of the background information that is known by Weed Inspectors. A large part of the presentation dealt with natural spread of scentless chamomile biocontrol agents. Added to the information on agent spread was a series of photos showing safe and dangerous sites for agent establishment. This should help Ducks Unlimited choose good release sites. For leafy spurge the core information was photos showing when the weed should be found to have a chance at eradication. Also, it was pointed out that noxious weed control is independent of industrial weed control and how noxious weeds like leafy spurge spread. If organizations like Ducks make good weed control decision then the spread of noxious weeds will be reduced.

2. Update on Noxious Weed Program was presented at SARM District Meetings 2003 which are located at six different venues in the province (Appendix 4 Pages 12 - 16). The audience was composed of Reeves, Councillors and some Weed Inspectors. Outlined was the information presented at the WITCs 2003 which included good business practices, weed control strategies and weed spread prevention. The latter starts with the appointment of a proactive Weed Inspector. The reason for presenting this type of information was to educated local government decision makers about the need for Weed Inspectors.

3. A summary of on-going activities of the Noxious Weed Program was presented to a meeting 2003 SCWG (Appendix 4 Pages 17 - 19). The SCWG is an advisory group for the Noxious Weed Program. The methods of information delivery that were talked about at the meeting were posters, articles, factsheets and presentations. Also, it was mentioned that the population build-up of biological control agents to equilibrium with noxious weeds takes more time than first thought. The SCWG made suggestions that helped to improve the education component of the project. Suggestions for specific information output were: facts sheets on control methods (scout, control and monitor), eradication – control expectations, awareness of persistent perennial weeds (field bindweed, leafy spurge and toadflax), more emphases on leafy spurge and preparation of a library of PowerPoint slides. This information was subsequently provided to agrologists, municipalities and Weed Inspectors. Those attending the 2003 meeting mentioned that awareness is working.

4. At a meeting at Loon Lake, representatives from surrounding municipalities that encompassed three District ADD Boards discussed the organization of weed control over a large area. The presentation, Stop the Spread of Scentless Chamomile, gave background information that supported the need for on-going weed control over many years (Appendix 4 Pages 20 - 25).

5. The purpose of the WITCs 2004 is to make Weed Inspectors aware of new information and provide basic education on the control of weeds. Part of the training session was a presentation called; Biological Control (Appendix 4 Pages 26 - 28). Information was presented on the effectiveness of the leafy spurge flea beetles and the devastating affect that grasshoppers have on the scentless chamomile gall midges. The highlight of the presentation was several photos that were taken in Russia that showed how well leafy spurge grows in its native environment. During 2004, the WITCs were held in Moose Jaw on April 5th, Yorkton on April 6th, and North Battleford on April 7th.

6. Another part of the WITCs 2004 was the presentation, How to Prevent Weed Spread, which detailed how to prevent weed spread and the most probable way that weeds spread (Appendix 4 Pages 29 - 34). The presentation cover modern theories of weed spread with practical methods that are known to stop weed spread.

7. The Rural Municipality of Corman Park has an effective integrated weed control program. Unfortunately, some of the land owners are not aware of the devastation that the weed can cause. A presentation called, The Leafy Spurge Problem, provided information on how the weed spreads, control methods and invasion (Appendix 4 Pages 35 - 37). Stressed in the presentation was the need for a proactive rather than a reactive Weed Inspector.

8. An Overview of Noxious Weeds in SK was presented to a mix audience from the Moose Jaw area (Appendix 4 Pages 38 - 41). In addition to landowners this meeting included representatives from the city, local municipalities and industrial landowners. The presentation was given at the request of the Saskatchewan Watershed Authority because leafy spurge grows in the Moose Jaw Creek valley. The presentation showed the importance of finding small patches of leafy spurge and starting an eradication program.

9. The presentation, Noxious Weeds – Future, was given at SARM District Meetings 2004 as an advertisement to entice attendees to visit the Information Booth that was set up out side the main meeting room (Appendix 4 Pages 42 - 43). This method of informing people about awareness of noxious and new weeds, and providing basic education on the devastation of these weeds worked very well.

11. Prepare a report documenting agent location

Monitoring information collected during the summer of 2003 was entered into the 2004 Scentless Chamomile Biological Control Agent Information Guide and the 2004 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide. These are electronic reports that are made available to individuals and organizations that are interested in collecting and releasing biocontrol agents. Data from 40 scentless chamomile seed weevil release sites, 22 scentless chamomile gall midge release sites and 110 leafy spurge beetle release sites were entered into the e-reports.

Similar to the above, monitoring information collected during the summer of 2004 was entered in to the 2005 Scentless Chamomile Biological Control Agent Information Guide and the 2005 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide. Data from 34 scentless chamomile seed weevil release sites, 21 scentless chamomile gall midge release sites and 97 leafy spurge beetle release sites were entered into the e-reports.

12. Obtain the GPS location for release sites and map

Waypoints for the monitored sites were previously recorded. The map of waypoints developed during January-March 2003 is suitable and will be used for local area mapping in 2004 and 2005.

When new release sites are visited, waypoints are recorded.

13. Develop and deliver a roadside weed control program

Information on how to develop and implement a roadside weed control program and how to prevent weed spread was based on integrated weed control. The approach used weed Awareness, Education and Control. Awareness is informing Weed Inspectors and the public of the danger of new and noxious weed. An important part of Awareness is weed identification. Education is learning about the biology and ecology of weeds. Control is the use of Integrated Weed Control methods such as biocontrol, chemical, ecological and physical. The strategy used was weed Exclusion, Eradication and Containment. Exclusion means using quarantine to keep new and noxious weeds at far away locations. Eradication is the reduction of a population of weeds to zero. Containment is keeping a weed population within a specific area. The procedure to control weeds uses 1) scouting for a weed, 2) controlling the weed using Integrated Weed Control and then 3) monitoring for success of the control treatment.

Articles The articles that were published in the Crop Protection News and Rural Councillor were designed to make Weed Inspectors, professional agriculturists and the public aware of issues that are important for effective noxious weed control. The articles educate by providing information on noxious weeds and integrated weed control methods. Most of the topics were authored as a response to questions and events that were raised by Weed Inspectors, professional agriculturists and the public.

1. Weed Inspectors and members of the public are often not aware of the number of years that on-going control is needed for perennial noxious weeds. Awareness of the need for a 10-year control program was presented in the October/November 2003 issue of the Rural Councillor (Appendix 1 Pages 1 - 2). The title of the article is: How Often Do You Need To Retreat To Control Perennial Weeds? The article emphasises the length of time, 3 to 20^+ years that seed can remain viable in the soil, germinate and establish new noxious weed patches.

2. An article, Noxious Weeds Take Money Out of Your Pocket, which was published in the December 2003/January 2004 issue of the Rural Councillor, explained how difficult it is to calculate weed losses (Appendix 1 Pages 3 - 4). Economic loss because of harvest interference (weed twining around a crop), physical – chemical attributes (thorns – weed palatability) are difficult to quantify but are very important for a successful farm and ranch business.

3. Weeds are Expensive was published in the December 2003/January 2004 issue of the Rural Councillor to emphasis the cost of weeds to a regional economy (Appendix 1 Pages 5 - 6). The North Dakota economic model was used to calculate the monetary loss to a rural municipality in southeast Saskatchewan. The economic calculations included direct (lost grazing) and secondary (business sector loss) impacts.

4. Leafy spurge is extremely difficult to control. The article, Leafy Spurge is no Illusion, in the February/March 2004 issue of the Rural Councillor explained the

various control options for the weed (Appendix 1 Pages 7 - 8). These are leaving it alone, control with herbicides, Integrated Weed Control and suppression with herbicides.

5. When there are limited resources available for weed control and control is expensive for persistence perennial weeds, then it is important to decide when eradication is a reasonable option. To accomplish this Weed Inspectors should develop a plan to find and treat noxious weeds in small patches. The article, A Detailed Management Plan to Stop Weed Spread in the April/May 2004 issue of the Rural Councillor outlined the general principles for successful weed prevention (Appendix 1 Page 9).

6. A record of weed location, control method and effectiveness should be kept by Weed Inspectors to enhance the opportunity for eradication or ensure that a long term weed control program is effective. Information on the requirements for a weed record keeping system was published in the June/July 2004 issue of the Rural Councillor (Appendix 1 Pages 10 - 11). The title of the article is Good Record Keeping is a Necessity - For this generation and the next!

7. The summer of 2004 was cooler than normal. The emergence of some biocontrol agents was later then in the previous warm summers. Field observations of the synchronization between biocontrol agents and noxious weeds were included in the article: Chilly Reception for Biological Control Agents which was published in the Crop Production News (Appendix 1 Pages 12 - 13).

8. Information of how Weed Inspectors and the public can collect and release seed weevils for the control of scentless chamomile was published in the August/September 2004 issue of the Rural Councillor (Appendix 1 Page 14). The title of the article is Scentless Chamomile Seed Weevil Collection and Re-Distribution.

9. An article titled, Scentless Chamomile Gall Midge Collection and Re-Distribution, explained how Weed Inspectors and the public can collect and release scentless chamomile gall midges for the biocontrol of scentless chamomile (Appendix 1 Pages 15 - 16). This article is published in the October/November 2004 issue of the Rural Councillor.

10. An article in the December 2004/January 2005 issue of the Rural Councillor summarized the results from two research articles that documented the passage of viable leafy spurge seed through the digestive tract of sheep (Appendix 1 Pages 17 – 18). The title of the article is: Using Sheep for Leafy Spurge Control. Before sheep are moved from an area with leafy spurge to an area without leafy spurge, they should be fed clean feed for 5 days.

Information Booths Information on Awareness, Education and Control was presented in booths at the SARM conventions and district meetings. The target audiences were Reeves, Councillors and a few Weed Inspectors. The method of expression that best presented the information was an Information Booth.

Similar information was presented to Weed Inspectors, landowners, and a few Reeves and Councillors at the WITCs. Usually the Information Booths that were at the SARM Conventions, SARM Midterm Conventions and districts meetings were used at the WITCs. By doing this similar information was provided to the Reeves and Councillors who make the decisions on weed control expenditures and Weed Inspectors who are responsible for enforcing the act.

1. **SARM District Meetings 2003**
   An Information Booth was set up at 6 District Meetings and it contained information on: 1) several new and known weeds in the province, 2) noxious weed spread and 3) biocontrol of leafy spurge (Appendix 2 Pages 1 – 21). This Information Booth was presented first at the SARM District Meetings 2003.

   Weed Identification, Biology and Ecology and Location were presented in part of an Information Booth for new and known weeds in the province (Appendix 2 Pages 1 - 6). The weeds selected were common crupina (*Crupina vulgaris*), field bindweed (*Convolvulus arvensis*), spotted knapweed (*Centaurea maculosa*), wild parsnip (*Pastinaca sativa*), yellow starthistle (*Centaurea solstitialis*) and yellow toadflax (*Linaria vulgaris*). The intent of the information that was presented in the booth was to make Reeves, Councillors and Weed Inspectors aware of these weeds and to provide education on identification.

   During the winter of 2002 – 2003 there was an unprecedented transport of hay and straw within the province that had the potential for spreading noxious weeds. The weed that was most likely to spread was leafy spurge. Reeves, Councillors and Weed Inspectors were made aware of the potential spread of leafy spurge in part of the Information Booth. This educational feature covered, 1) Noxious Weed Spread (Appendix 2 Pages 7 - 12), 2) Why Leafy Spurge Control is Difficult (Appendix 2 Page 13), 3) Leafy Spurge Beetle Life Cycle (Appendix 2 Page 14), 4) Collecting and Releasing Leafy Spurge Beetles (Appendix 2 Page 15), and 5) Leafy Spurge Beetle Collection and Transport (Appendix 2 Page 16). The purpose was to supply educational information for Weed Inspectors to enable them to locate small leafy spurge patches for eradication and use beetles for large areas with leafy spurge.

   Part of the booth contained similar information to what was presented to agrologists at the Soil and Crops 2003 (Appendix 2 Pages 17 - 21). The Distribution of Biological Control Agents for Scentless Chamomile in Saskatchewan explained the latest information that was known on how scentless chamomile seed weevils and gall midges spread naturally throughout the province.

2. **SARM Midterm Convention 2003 and WITCs 2004**

A new display was designed for the Information Booth at the SARM Midterm Convention 2003 (Appendix 2 Pages 22 – 34). This Information Booth was shown first at the SARM Midterm Convention for Reeves and Councillors and then used again at the WITCs for 2004. Weed Inspectors saw the same information as the Reeves and Councillors.

Part of the display was a summary of known information on scentless chamomile biocontrol agents and information that was collected during the previous summer on agent establishment (Appendix 2 Pages 22 - 33). The topics in the display for the scentless chamomile seed weevil were; 1) Scentless Chamomile Seed Weevil (Appendix 2 Page 22), 2) How and When Do I Collect Scentless Chamomile Seed Weevils? (Appendix 2 Page 23), and 3) How Well are Seed Weevils Establishing on Scentless Chamomile? (Appendix 2 Page 24).

The topics presented for the scentless chamomile gall midge were; 1) Scentless Chamomile Gall Midge Eggs (Appendix 2 Page 25), 2) Scentless Chamomile Gall Midge (Appendix 2 Page 25), 3) How and When Do I Collect Scentless Chamomile Gall Midges? (Appendix 2 Page 26) and 4) How Well are Gall Midges Establishing on Scentless Chamomile? (Appendix 2 Page 27).

A summary of the performance of leafy spurge flea beetles during 2003 was presented in the second part of the display in the Information Booth (Appendix 2 Pages 28 - 33). The topics covered were; 1) The Life Cycle of Leafy Spurge (Appendix 2 Page 28), 2) Leafy Spurge Beetle Identification (Appendix 2 Page 29), 3) When Do I Collect Leafy Spurge Beetles? (Appendix 2 Page 30), 4) Leafy Spurge Release Sites (Appendix 2 Page 31), 5) How Effective are Beetles for the Control of Leafy Spurge? (Appendix 2 Page 32) and 6) Loss of Grazing from Leafy Spurge (Appendix 2 Page 33). On sites where the beetles established, leafy spurge was not found on 5% of the known release sites. On one-third of the release sites, leafy spurge covered 15% of the soil surface, which results in a grazing loss of 19%. This information was published in an article in the February/March 2004 issue of the Rural Councillor (Appendix 1 Pages 7 - 8). The article, Leafy Spurge is No Illusion, was used as a handout at the Information Booth.

Part of the Information Booth was a silent salesman called; Weed Inspector Report (Appendix 2 Page 34). The graph showed a constant rise in the number of Rural Municipalities with Weed Inspectors from 79 in 1999 to 202 in 2003.

3. SARM Convention 2004 and WITCs 2004

A new Information Booth was developed for the SARM Convention 2004 and used at the WITCs 2004 (Appendix 2 Page 35 - 55). The Information Booths at the WITCs 2004 contained the same information that was presented at the SARM Convention 2004.

Part of the booth contained information on:

1) plants that grows on many isolated sites in Saskatchewan; Common Tansy (*Tanacetum vulgare*), Field Bindweed (*Convolvulus arvensis*), Leafy Spurge (*Euphorbia esula*) and Yellow Toadflax (*Linaria vulgaris*) (Appendix 2 Pages 35 -39),

2) plants that grows on a few isolated sites in Saskatchewan: Hoary Alyssum (*Berteroa incana*), Spotted Knapweed (*Centaurea maculosa*) and Wild Parsnip (*Pastinaca sativa*) (Appendix 2 Pages 40 - 43) and

3) plants not known to grow in Saskatchewan; Common Crupina (*Crupina vulgaris*) and Yellow Starthistle (*Centaurea solstitialis*) (Appendix 2 Pages 44 - 46).

The awareness leaflets provided information on Identification, Biology and Ecology, and Location. These leaflets are an updated and improved version of the new and known weeds that were presented in the Information Booth at the SARM Convention 2003 and WITCs 2003. At the November meeting of the SCWG, staff of the Saskatchewan Extension Service liked the idea of a leaflet with good photos with a minimal amount of text. At their suggestion, the leaflets were reformatted and are being prepared for print and distribution to Weed Inspectors and Rural Municipalities.

In the same part of the display a series of posters called, Wanted Dead to Prevent Spread, were prepared for field bindweed, leafy spurge and yellow toadflax (Appendix 2 Pages 47 - 50). The format used was similar to the Wanted Dead posters that were used successfully for scentless chamomile.

Part of the Information Booth contained information on the importance of record keeping for effective weed control (Appendix 2 Pages 51 - 55).

The Record of Noxious Weed Control is a procedure to keep a record of weed location, and control methods and effectiveness. This is the same information that was presented in the article that was published in the June/July 2004 issue of the Rural Councillor (Appendix 1 Pages 10 - 11). The title of the article is Good Record Keeping is a Necessity - For this generation and the next! The article was used as a handout at the Information Booth. Also, page size copies of the Record of Noxious Weed Control were made available to all who attended the booth and are available for down load from the SAFRR web site.

The Noxious Weed GPS System was developed by members of District 43 ADD Board, which is located in the Watrous area (Appendix 2 Pages 54 - 55). They requested space at the Information Booth to display their GPS system. This approach compliments the Record of Noxious Weed Control that was developed by the Noxious Weed Program.

4. SARM Midterm Convention 2004

A review of the recent research literature provided the answers to questions that are often asked by Weed Inspectors. Research articles were summarized and the essential data was presented at an Information Booth at the SARM Midterm Convention 2004 (Appendix 2 Pages 56 – 70). Let Research Answer Your Questions was the part of the booth that introduced the topic (Appendix 2 Page 56).

Two research articles dealt with the passage of viable leafy spurge seed through the gastrointestinal tract of sheep. The titles for this information at the booth were; 'Will Viable Seed of Leafy Spurge Pass Through the Digestive Tract of Sheep?' (Appendix 2 Page 57) and 'Recovery of Leafy Spurge Seed from Sheep' (Appendix 2 Page 58). Also, included in this part of the Information Booth were photos of floral development and seeds of leafy spurge (Appendix 2 Page 59). Sheep will pass viable seed of leafy spurge through their gastrointestinal tract. To ensure that viable leafy spurge seed are not transported in sheep, they should be fed leafy spurge free feed for at least 5 days before being moved from a pasture with the weed to a pasture without the weed.

Kirby et al. published an excellent article on how long it takes flea beetles to seriously damage the roots of leafy spurge. The title of this part of the display was; 'Leafy Spurge Suppression with Flea Beetles' (Appendix 2 Page 60 - 61). When under attack by beetles, after seven to eight years, 16% of the roots remained alive.

'Biological Control of Leafy Spurge with Beetles' documented the performance of the black dot and black flea beetles in North Dakota (Appendix 2 Pages 62 - 63). The number of black dot flea beetles per sweep was always low whereas the number of black flea beetles varied from year to year.

To help better understand why leafy spurge is difficult to control, part of the Information Booth was used to explain the growth of the weed's roots. This part of the display was called 'How Does Leafy Spurge Grow' (Appendix 2 Page 64). The feature part of this display was the massive roots system of a two-year-old plant.

Biocontrol of leafy spurge with beetles is an equilibrium between the agents and the noxious weed. The weed and the beetles will always be present. 'Part 1: Long Term Control of Leafy Spurge with Flea Beetles' (Appendix 2 Page 65) shows three photos with declining leafy spurge whereas 'Part 2: Long Term Control of Leafy Spurge with Flea Beetles' (Appendix 2 Pages 66 - 67) show the reappearance of the weed.

Part of the display explained why every municipality must appoint a Weed Inspector. The titles for this part of the display are 'Why Every Municipality Needs a Proactive Weed Inspector' (Appendix 2 Page 68) and 'Always Appoint a

Weed Inspector to Stop Weed Spread' (Appendix 2 Page 69). The key to stopping the spread of noxious weeds is appointing a Weed Inspector and encouraging the Weed Inspector to be proactive

In the fall leafy spurge is easy to spot on the landscape because of its crimson red colour. This is shown in part of the Information Booth with the title: 'Leafy Spurge in the Fall' (Appendix 2 Page 70).

Reports WSCSACSA (Weed Sub-council to the Saskatchewan Advisory Council on Soils & Agronomy) is an advisory committee composed of agrologists from government and private organizations that have an interest in weed control in the province. Each year a report outlining the various activities of the Noxious Weed Program is presented (Appendix 5 Page 1 – 6). Since those attending the meeting are involved in the control of weeds on cropland, they receive valuable information on the control of noxious weeds and on industrial weed control. Most weed workers in the province are aware of the activities associated with the Noxious Weed Program.

1. The 2003 report to the fall meeting of the WSCSACSA provided the latest information on biocontrol, number of Weed Inspector appointments and the types of meetings for information delivery (Appendix 5 Pages 1 – 3).

2. The 2004 report to the spring meeting of the WSCSACSA outlined the content of articles authored, biocontrol agents monitoring and information delivered at SARM meetings (Appendix 5 Page 4).

3. The 2004 report to the fall meeting of the WSCSACSA outlined information on Weed Inspector appointments, monitoring of biocontrol agents, information presented at WITCs and presentations at SARM meetings (Appendix 5 Pages 5 – 6).

Slide Libraries At the November 2003 meeting of the SCWG several attendees asked if the PowerPoint slides that are used in presentations supporting the Noxious Weed Program could be made available to agrologists in the province. This initiated the development of two slide libraries that are available upon request to the Coordinator of the Noxious Weed Program (Appendix 6 Pages 1 – 24).

1. The Leafy Spurge slide library has 71 documented slides that were obtained from presentations made from 1999 to February 2004 (Appendix 6 Pages 1 - 12).

2. The Scentless Chamomile slide library has 67 documented slides that were obtained from presentations made from 1999 to February 2004 (Appendix 6 Pages 13 - 24).

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(c) Personnel

Dr. Garry Bowes, Coordinator, Noxious Weed Program

(d) Equipment

Nil

(e) Project Development Materials

See Appendix 1 for a list of articles published in the Rural Councillor, Appendix 6 for PowerPoint slide libraries and Appendix 7 for technical articles.

(f) Project Photos

A photograph was taken of each release site that was monitored. Prints were developed and scanned. Each e-photograph was coded and the code was entered into the 2004 Scentless Chamomile Biological Control Agent Information Guide and the 2004 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide. E-photographs are available upon request.

(g) Acknowledgement

The following acknowledgement appeared at the end of Information Booths, PowerPoint presentations and print articles:

Financial support for The Noxious Weed Program is provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada.

How Often Do You Need To Retreat To Control Perennial Weeds?

Garry Bowes • Noxious Weed Program

Table 1. Ability of Noxious Perennial Weeds to Reproduce

Noxious Perennial Weeds	Number of years that seed can remain viable in soil	Type of underground structure that can produce new top growth
5 Noxious Weeds Named in *The Noxious Weed Act, 1984*		
1. Field bindweed	20, up to 50	Creeping Rootstocks
2. Heart-podded hoary cress	3	Creeping Rootstocks
3. Leafy spurge	Up to 8	Creeping Rootstocks
4. Russian Knapweed	3 - 8	Creeping Rootstocks
5. Yellow toadflax	8	Creeping Rootstocks
Other Feared Noxious Weeds		
1. Scentless chamomile *	Up to 10	nil
2. Spotted knapweed †	8 or more	crowns

* Scentless chamomile is most often a summer or winter annual but can be perennial

† Spotted knapweed is a biennial or short-lived (5 to 8 years) perennial

One answer is as long as required to control the weed. The next question is how long is long? Most likely for a perennial weed, repeated control will be needed for more than 10 years. Because long term control is costly, it is best to develop a long term plan which will provide inexpensive control.

The first step in a long term plan is to understand the life cycle of a herbaceous perennial plant. Perennial weeds live longer than two years and may live indefinitely. These weeds may reproduce by seed, but most reproduce by seed and some type of spreading vegetative plant part. This includes stolons, rhizomes, creeping rootstocks and tubers. A control plan must kill all parts of a plant, as well as seedlings, to prevent new weed growth.

Seeds of perennial plants may germinate in spring or summer. The seedling becomes a perennial plant and can reproduce from rootstalks after emergence. In the fall, the top growth dies, but the root system, which often has a spreading underground structure, will survive the winter. In the spring, perennial weeds resume growth from buds on the plants crown, roots or tubers. During the second year and most years thereafter, perennial weeds will flower and set seed. Therefore, starting the third year and for years thereafter, a Weed Inspector can expect a perennial weed to expand its domain from seed and often from some type of spreading underground vegetative plant part.

Five of the noxious weeds in The *Noxious Weed Act, 1984* are special because they are very difficult to control. Table 1 shows the number of years that seed can remain viable in the soil and the type of underground reproductive structures that can produce new growth each year. For adequate long term control for any of these weeds, a 10-year plan is needed. Often, the viability and dormancy of seed collected varies widely from weed to weed and from different sites and years. Deep burial of weed seeds can prolong seed dormancy. So, 10 years is a suggested guideline when planning long term control. All that is required is for a shoot to produce seed during any one of the 10 years to start a new 10-year control plan. Therefore, once a control plan starts, the perennial noxious weed must never be allowed to produce seed. From the start of a long-term plan, weed control should focus on killing the plants entire root system.

Two other noxious weeds listed in Table 1 are the feared scentless chamomile and a recent introduction—spotted knapweed—to the province. Seed of both species can remain viable in the soil for a long time, necessitating a long term control plan. Scentless chamomile is the priority weed of the Noxious Weed Program. Emphasis is on integrated long term control. The few known sites where spotted knapweed has established are treated as required to kill the weed and prevent seed production.

In Saskatchewan, mowing and herbicides have been the main methods for controlling noxious weeds. To be effective these weed control methods must prevent seed production and kill the weeds' underground reproductive root structure for 10 years. Even after 10 years, there is no assurance that the weed will completely disappear.

Mowing gives a uniform growth appearance to vegetation containing noxious weeds which is visually pleasing to the public, but it is difficult to control perennial noxious weeds by mowing. Cutting controls plant top growth and seed production. Noxious weeds should be mowed just before flowering when the energy reserves in roots are low. One pass of a mower will not kill weeds which have underground reproductive structures. The weed produces new growth from reserve food that is stored in reproductive structures. To be effective, perennial weeds need to be mowed many times a year or several years to exhaust the food supply in the underground reproductive structures.

Herbicides control, suppress or kill noxious weeds. On a right-of-way, the appearance of brown forage, called 'a brownout', can be unsightly to the public. Herbicides should be used before perennial weeds set seed to minimize the amount of seeds in the soil seed bank. Therefore, the best time for control may not meet public approval.

The most effective time to apply herbicides to perennial weeds is at bud to early flowering stage. At this stage, the reproductive structures of perennial plants have the lowest amount food reserves and begin to move energy reserves from their above-ground growth to roots in preparation for winter survival. The movement of food reserves can assist the movement of herbicides to underground reproductive structures.

When herbicides are applied, some is intercepted by leaves, enters the leaves and controls the plant. Herbicides not intercepted by plants fall to the soil. Herbicides not entering leaf tissue can be washed off by rain and fall to the soil.

Herbicides have long, short or no residual activity. Herbicides with a long term residual activity in soil can kill new growth that is initiated from underground reproductive structures and seedlings. Herbicides which have short or no residual activity kill the top growth of plants and may or may not move (translocate) to plant structures that are growing underground. After a treatment with a short or no residual herbicide, any new weed growth must be retreated.

Selecting the appropriate herbicide to control a weed and not harm the environment is very important.

The relative amount of sand, silt and clay in soil, along with the organic matter has a direct influence on herbicide activity and persistence. Herbicides that are soluble in water will readily move into sandy soils and off the surface of packed clay soils after a heavy rain. This can result in herbicide movement, causing serious environmental pollution and off-site damage. Often, the selection of a herbicide that has a long, short or no residual activity will depend more on the risk of environmental pollution or off-site damage, than on the most cost effective herbicide.

Most often, a 10-year right-of-way noxious weed control plan will use mowing and herbicides. A plan should include a feasibility study on the use of herbicides that have a short or long residual activity. Vegetation on road rights-of-ways needs to be mowed for road safety. This is called non-cropland weed control or industrial vegetation control. Sometimes noxious weed control can be combined with industrial vegetation management. This should only be attempted when mowing will prevent seed set and is at the appropriate time to exhaust the supply of root reserves (i.e. early flowering).

The choice of a mower or herbicide treatment may depend on the environment. During years when drought is prevalent, roots of perennial noxious weeds obtain water from deep in the soil profile. Grasses are shallow rooters and produce limited growth in dry years. In dry years, noxious weed control will be needed before industrial vegetation management. In wet years the time to control perennial weeds and road right-of-way vegetation may happen together.

Weed control costs should be estimated during the winter. The cost for a herbicide treatment should include an estimate for application. The yearly expenditure for herbicides is influenced by residual activity and grass competition. A herbicide such a Tordon 22K, which has a long residual activity, may control a noxious weed for several years, whereas 2,4-D, which has a short residual activity, may need to be applied several times a year. It may be possible to use a residual herbicide to control well established perennial plants, and a short residual herbicide to control seedlings. An established grass stand, competing with seedlings of a perennial weed, can reduce the number of seedlings that become established, and help to reduce herbicide cost. The cost for mowing should include a mower, power unit and labour.

Every municipality should have a line item in their budget for noxious weed control. This should include budgeting for Weed Inspectors pay, and costs for more frequent mowing, herbicide purchases and application costs.

Dr. Garry Bowes is the Coordinator of the Noxious Weed Program (p 306.933.7695, f 306.933.7352, e gbowes@agr.gov.sk.ca).

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Noxious Weeds Take Money Out of Your Pocket

By Garry Bowes

Noxious Weed Program

Most emphatically yes, when the worst of the noxious weeds are growing on your land. These weeds reduce yields when they interfere (competition) with crop and pasture growth. Noxious Weeds interfere with harvesting by slowing or preventing the event. Noxious Weeds may have physical (thorns) or chemical (forage palatability) attributes that interfere with grazing. Noxious Weeds may be poisonous to humans and/or animals.

The economic loss from noxious weeds can be calculated when a weed competes with a field or forage crop. Economic losses from noxious weeds because of harvest interference, physical - chemical attributes and poison are difficult to quantify. However, these losses can be very important in the operation of a successful farm and ranch business.

For the five noxious weeds with special powers under The Noxious Weed Act, the types of loss that can be expected are well documented. Generally, the weeds listed in Table 1 invade an area, become established and then spread. The damage caused by these weeds is often more than a serious decline in crop production. This includes some combination of weed competition with harvest interference, physical - chemical attributes and/or poison.

The best control method is **prevention**. Learn and understand all you can about noxious weeds that are not growing on your land and don't ever let them establish. Find out how close these weeds are to your land and always investigate before purchasing agricultural commodities to ensure noxious weeds are not hitch-hikers. Should prevention fail, then **eradicate**. Noxious weeds can only be eradicated when they are established for only a few years in a small area. If eradication fails, then **contain** the weed infestation and stop spread.

Field bindweed is a persistent perennial vine that reduces yields when it weaves around and over desirable crop and forage plants. A document from Idaho indicates that field bindweed can reduce crop yield by 50 to 60%. The twisting nature of the vine, which grows late into the growing season, causes an unwanted expense and aggravation when harvesting field and forage crops. Yield losses from a few plants can be significant. A single plant can grow 0.3 to 2 m in a year, form a mat on the soil surface and produce a tap root more than 3 m. The deep rooted plant takes soil moisture from the top 60 cm of the soil surface that would be otherwise available to crop plants. Bindweed provides little forage for grazing. Seeds can remain viable for 20 years or more in the soil. Field bindweed is invasive.

Heart-podded hoary cress is a perennial that can grow 20 – 50 cm tall. It reduces the yields of grain crops and alfalfa. Hoary cress is reported to be toxic to livestock. The weed is a host for the cabbage seedpod weevil. While hoary cress is perennial weed and was feared in the late 1800's, time has shown that the weed is not that invasive.

Leafy spurge is a long-lived, deep-rooted, aggressive perennial noxious weed that can displace all other vegetation in pasture, rangeland and native habitats. The grazing loss for buffalo, cattle and horses can be 100%. The loss on land with a high percentage covered with leafy spurge reduces its ability to make a living by cattle ranching.

Table 1. Losses from Weeds

Noxious Perennial Weeds	Weed Losses	Origin of the report
	5 Noxious Weeds with Special Powers in *The Noxious Weed Act, 1984*	
1. Field bindweed	· Crop yields can be reduced 50-60% by dense infestation · Stems twine around and over other plants · Interferes with harvesting · Excellent competitor for soil moisture · Provided little forage for grazing	ID
2. Heart-podded hoary cress	· Reduces the yields of grain crops and alfalfa · Toxic to livestock (may taint milk) · Host for cabbage seedpod weevil	
3. Leafy spurge	· Forage yield can be reduced 100% · Cattle avoid in pastures spurge is toxic	
4. Russian Knapw	64 shoots/m2 have reduced grain yields by 28 - 75% void in pastures	Russia
5. Yellow toadflax	educed canola yield 20% and wheat yield by 12% ures estock ost for cucumber mosaic virus · Host for broad bean wilt virus	AB
	Other Problem Noxious Weeds	
1. Scentless chamomile	· Unpalatable to livestock · Summer annual plants reduce wheat 55%	SK
2. Spotted knapweed	· Allelopathy suppresses surrounding plant growth · Low palatability, contains a bitter compound · Reduces soil water storage (increases soil erosion)	

Scentless chamomile is most often a summer or winter annual but can be perennial

Spotted knapweed is a biennial or short-lived (3 to 8 years) perennial

The option for this land is to raise sheep and goats which graze the noxious weed. Cattle avoid small patches of leafy spurge that grow with grasses on pasture and grazing land. The grazing loss is the grass displaced by leafy spurge and the grass growing near the weed which is called the 'barrier effect'. The white 'latex-like' substance is toxic to livestock and humans. Every time an area of grassland is avoided because it contains toxic leafy spurge, there is a 100% grazing loss. Leafy spurge is very invasive.

Russian Knapweed is a deep-rooted, rhizomatous, perennial noxious weed. Losses are substantial because the weed dominates desirable vegetation and can cover an area of 12 m^2 within 2 years. In Russia, 11 – 64 shoots/m^2 have reduced grain yields by 28 - 75%. There is a loss in pastures when grazing animals avoid the weed. Russian knapweed is poisonous to horses. The weed is poor seed producer and is not as invasive as the other persistent perennial weeds.

Yellow toadflax is deep-rooted, aggressive perennial weed that can displace the established vegetation in pastures and native habitats. Cattle avoid yellow toadflax in a pasture. The weed can be poisonous to livestock. This is a devastating loss. In cropland, 74 toadflax stem/m^2 reduced canola yield 20% and wheat yield by 12%. The weed is the host for the cucumber mosaic virus and the broad bean wilt virus. Yellow toadflax is invasive and continues to spread in the province.

Scentless chamomile is a summer annual, winter annual or short-lived perennial that is a prolific seed producer. In a pasture, loss occurs because the weed is unpalatable to livestock. The weed reduces the yield of annual crops. When a growing season is cool and wet-to-moist, summer annual plants can reduce the yield of wheat by 55%. The tough, twining nature of the stem causes an unwanted expense when harvesting. Seed production is high with an average plant producing 300,000 seeds per year. Scentless chamomile is a very invasive weed and is rapidly spreading throughout the province.

Spotted knapweed is a tap-rooted biennial or short lived perennial that is a prolific seed producer. The weed establishes in disturbed sites and then gradually but continually invades undisturbed, good condition rangeland. The loss in productivity is small at first but is a gradual and continuous drain on the pocket book. With widespread invasion, pasture and rangeland becomes overgrazed because the weed contains a bitter compound and has a low palatability. Spotted knapweed contains an allelopathic compound that suppresses neighbouring plant growth, reducing productivity of grass around it and assisting the spread of the weed. An expensive loss is reduced soil water storage and increased soil erosion. As spotted knapweed invades, the tap-rooted plant with poor water holding capacity replaces the fibrous-rooted grass species with good water holding capacity. In a North Dakota study, rainfall runoff from a site with 90% bunchgrass was 23%, which removed 39 pounds of the sediment/acre. The runoff from a nearby site with 85% spotted knapweed was 36%, which removed 114 pounds of sediment/acre. Spotted knapweed is an invasive weed.

Dr. Garry Bowes is the Coordinator of the Noxious Weed Program (p 306.933.7695, f 306.933.7352, e gbowes@agr.gov.sk.ca).

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Weeds are Expensive

By Garry Bowes

Noxious Weed Program

Growing weeds is an expense venture for every person living in a municipality. While the total loss for weeds is difficult to calculate, an estimate for leafy spurge can be calculated when land is used for grazing. The loss for Manitoba is $20 million per year with a one-time grazing land value loss of $30 million. For North Dakota, the loss is $75 million per year with a grazing land value loss of $137 million. The impact of leafy spurge on the regional economy in Saskatchewan can not be fully appreciated until a similar calculation is made for a typical rural municipality, which may include the surrounding business area. This is very important for Saskatchewan because the cost of growing weeds and for noxious weed control affects the municipal treasury.

ECONOMIC IMPACT OF LETTING LEAFY SPURGE GROW

For a rural municipality in eastern Saskatchewan, with leafy spurge covering 80% or more of the land surface of a 160 acres, the loss was calculated at $11,498 per year with a one-time grazing land value loss of $21,974. This is an estimate of the economic loss to a rural municipality and should not be confused with the loss incurred by an individual land owner. Understanding how this high cost was calculated should motivate any municipal official to **prevent** weed establishment, **eradicate** small weed patches and **contain** the spread of large weed infestation.

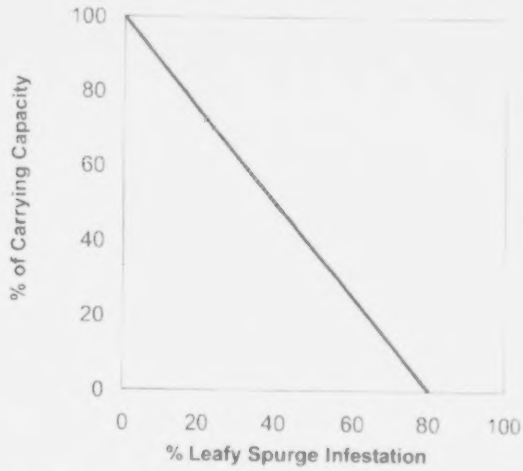

Figure 1. Reduced carrying capacity from leafy spurge (Kirby and Lym 1989)

RANGELAND ECONOMIC MODEL

A rangeland economics model was developed for North Dakota which quantifies most of the losses to the state that could be attributed to leafy spurge. These losses include income for cattle producers, reduced production outlays, secondary economic impact attributed to business, reduced land value, impact of the weed on wildlife habitat and the cost to mitigate and/or repair sites exposed to rapid water runoff and soil movement (erosion).

The North Dakota economics model was evaluated and used for Manitoba. The multipliers used in the model were accepted for Manitoba and are thought to be valid for eastern Saskatchewan. This article uses the assumptions that were made for Manitoba and applies them to a rural municipality in eastern Saskatchewan. While the North Dakota model gives an approximation for eastern Saskatchewan, it would be better to do a detailed study for the each vegetation region of the province. For the province, a similar estimate can be calculated after the survey for leafy spurge is completed.

ECONOMIC LOSS CALCULATION

This article assumes that 160 acre of leafy spurge is growing on grazing land in a rural municipality in the eastern portion of the province. For the calculation, it is assumed that leafy spurge covers more than 80% of the 160 acres. Because there is no forage available for cattle grazing when leafy spurge covers more than 80% of the soil surface, there is no grazing (Figure 1).

For Manitoba, the carrying capacity (AUM/acre) for native and tame pastures was used to estimate the grazing loss for leafy spurge infested areas. Carrying capacity is the highest stocking rate that can be achieved without inducing damage to vegetation. Carrying capacity is measured in animal unit months (AUMs) and is the amount of feed required per month by a one thousand pound animal for maintenance and growth. For western Manitoba, the loss was 0.68 AUMs for an acre infested with leafy spurge. The loss for the rural municipality in eastern Saskatchewan was assumed to be similar. Each year, the loss is 109 AUMs (0.68 AUMs x 160 acres) of grazing to leafy spurge (Table 1).

DIRECT ECONOMIC IMPACTS

The value of a lost AUM was calculated from current market rental rates for grazing land in proportion to the amount of native and tame pasture in leafy spurge infested areas of western Manitoba. Rental rate divided by AUMs per acre gave the rental rate per AUM. This was $12.68/AUM. The lost income by cattle producers to the economic activity of the rural municipality was $1,382/year ($12.68/AUM x 109 AUMs) (Table 1).

A reduction in herd size has an impact on production expenditures for outlays such as forage, grain and livestock services. A reduction in outlays is a decrease in the revenue for the businesses that supply these services. For North Dakota and Manitoba, this was calculated to be 1.6 times the lost income by cattle producers. For 160 acres of leafy spurge, the loss from reduced production expenditures was $2,211/year ($1,382/year x 1.6). For the typical municipality, the direct economic impact was $3,593 ($1,382 + $2,211) (Table 1).

SECONDARY ECONOMIC IMPACTS

In addition to a direct loss, there is a secondary economic impact on rural business activities such as: business services, construction, personal services, retail trade and transportation. The secondary economic impact for North Dakota was 2.2 times the direct impact. The multiplier was accepted for the Manitoba economic model and used for eastern Saskatchewan. The loss for the business sectors was $7,905/year ($3,593 x 2.2) (Table 1).

REDUCED GRAZING LAND VALUE

Because grazing by cattle is no longer an option on land infested with leafy spurge, land values are reduced. For North Dakota, the non-leafy spurge infested land sale value-to-rent ratio was 15.9. This was accepted for Manitoba and used for the typical municipality. The reduced land value was 15.9 times the value of the loss by cattle producers ($1,382/year). For the municipality, the grazing land value loss is a one time loss of $21,974 (Table 1).

For land which has less than 80% leafy spurge cover, use the model multipliers with the number of acres of leafy spurge. If leafy spurge covers 25% of 160 acre grazing area, then estimate the economic loss on 40 acres of leafy spurge (Figure 1). When leafy spurge covers 25%, the carrying capacity is reduced 31% and a 20 cow herd would be reduced to 14 head. For an estimate of carrying capacity, consult a regional Range Land Agrologist through a Rural Service Centre.

OTHER LOSSES

Use the following multipliers to estimate the losses to wildlife habitat and erosion because of leafy spurge invasion.

The impact of leafy spurge on wildlife habitat can be a reduced carrying capacity on native prairie for indigenous wildlife populations. This can include a reduction in native plants, decreased food source and/or lack of cover. A North Dakota study attempted to quantify the wildlife values by measuring consumptive (hunting) and non-consumptive (tourism) recreation spending. The loss was approximately $6.30 per acre of leafy spurge infested public land.

As leafy spurge, which is a tap-rooted plant, invades a pasture that is vegetated with fibrous-rooted grasses, the soil holds less water and runoff increases. As water runoff increases soil erosion increases. There is a cost to mitigate and/or repair sites exposed to rapid water runoff and soil movement. This reduced watershed value in North Dakota was calculated to be $1.47 per acre of native prairie that is infested with leafy spurge.

Dr. Garry Bowes is the Coordinator of the Noxious Weed Program (p 306.933.7695, f 306.933.7352, e gbowes@agr.gov.sk.ca)

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Table 1. Cost to a Rural Municipality of 160 acres of Leafy Spurge.

Events	
Grazing land impacted by leafy spurge	160 acre
Lost AUM/leafy spurge infested acre	0.68 AUMs
Lost grazing	109 AUMs/year
Direct Economic Impacts	
Value of a lost AUM	$12.68/AUM
Lost income to producers	**$1,382/year**
Multiplier for reduced production outlays (forage, grain, livestock services) for reduced herd	1.6 x lost income
Loss from reduced production outlays	**$2,211/year**
Direct economic impact	**$3,593/year**
Secondary Economic Impacts	
Multiplier for loss of other business sectors	2.2 x direct impact
Loss of other business sectors	**$7,905/year**
Total Direct and Secondary Economic Impacts	$11,498
Reduced Grazing Land Value	
Multiplier for reduced value	15.9 x lost AUM value
Reduced grazing land value	**$21,974/year**
Reduced habitat value (recreation)	**$6.30/acre**
Increased soil erosion and reduced water quality	**$1.47/acre**

Leafy Spurge is No Illusion

By Garry Bowes
Noxious Weed Program

Leafy spurge is a noxious perennial weed that invades lowlands, prairie, road right-of-ways, steep slopes and wasteland. The weed is extremely difficult to control.

What do you do with Leafy Spurge?

LEAVE IT ALONE

This is not an option for an aggressive invasive plant like leafy spurge. Visually scan land for leafy spurge. What you see will double in 10 years! Since the early 1900s, the acreage of leafy spurge in North Dakota and Manitoba has doubled every 10 years.

When leafy spurge covers 80% of the soil surface, there are practically no grasses and forbs available for grazing. When the weed crowds out native vegetation, bird and animal habitat is non-existent and endangered plant species become extinct. When purchasing land for cattle grazing, the value of leafy spurge covered land is zero.

This degree of agricultural and wildlife land destruction is not acceptable. Every effort must be made to control this devastating noxious weed.

CONTROL WITH HERBICIDES

Amitrol 240 at 15.2 to 18.5 L/acre, 2,4-D amine at 1.82 L/acre, Tordon 22K at 3.6 L/acre and Vanquish at 0.5 L/acre will control leafy spurge. The cost per acre is $93 to $114, $10, $143 and $16, respectively, for the four herbicides. Each year 2,4-D should be applied at least twice; a Tordon 22K treatment may last three to five years. Because leafy spurge seed can remain viable in soil for up to eight years, land managers should plan to use herbicides for 10 years. Even after 10 years, there is no guarantee that all of the viable seed in the soil has germinated. While it is difficult to justify blanket spraying of large areas of leafy spurge, herbicides can effectively control a few small leafy spurge patches in a large pasture.

INTEGRATED WEED CONTROL

No single method will effectively control leafy spurge. Integrated control, gives land managers numerous options for using different strategies for control in different habitats.

Selecting the most appropriate integrated control methods is always a challenge. Integrated control methods should not conflict with each other.

- The foundation for integrated control is biocontrol, using host-specific beetles. Black, black dot and brown dot adult leafy spurge beetles feed on the leaves of leafy spurge but most damage is caused by root feeding larvae. Root feeding stresses the plant and causes wounds that allow soil borne pathogens to invade and further damage the plant. This is the most economical control for large areas covered by leafy spurge.
- Herbicides effectively control small satellite leafy spurge patches, which helps to prevent spread (eg. treating an area 12 m wide at the edge of a large leafy spurge infested site). Controlling leafy spurge with a herbicide during July when adult leafy spurge beetles are feeding on leaves and laying eggs will drastically reduce population size.
- Mowing when leafy spurge is in flower prevents seed set but does not kill the plant. If an area is mowed in July, the only leafy spurge available to feed beetles is leaves on stems under the mow-cut line.
- Multi-species grazing, using cattle and sheep, will help to control leafy spurge. Using sheep to graze leafy spurge maintains grasses and forbs for cattle grazing.
- Sheep and goat grazing controls the top-growth of leafy spurge and provides revenue. Up to 80% of forage intake by sheep can be leafy spurge. Sheep and leafy spurge beetles are compatible. Sheep grazing decreases the density of leafy spurge, which provides a better opportunity for beetles to establish large populations. Beetles and sheep place two stresses on leafy spurge.
- Goats are more selective for leafy spurge than are sheep. The dietary overlap between goats and cattle ranges between 5 and 20% whereas for sheep and cattle the range is 20 to 35%. The stocking rate for sheep in North Dakota is 1 to 2 per acre of leafy spurge over a four-month grazing season. For goats, the stocking rate is 3 to 4 per acre of leafy spurge over a four-month grazing season.

HOW EFFECTIVE ARE LEAFY SPURGE BEETLES

The only food that leafy spurge beetles can survive on is leafy spurge. According to biological control theory, the weed is not eradicated. Over time, the weed population is suppressed and finally a small population of beetles live on a few remaining leafy spurge plants. If the leafy spurge population increases then the beetle population will increase.

There is a direct conflict between biological control theory and the wishes of managers and owners of land covered with leafy spurge. Anyone who has leafy spurge growing on their land wishes that the noxious weed will disappear and never return. Unfortunately, this does not happen very often. Some leafy spurge may always be present. The question is: how much leafy spurge can or will a land manager or owner tolerate?

When beetles are released on leafy spurge they either do not establish, or establish but control does not meet the client's expectation or, establish and suppress leafy spurge. To find out how leafy spurge beetles are performing in Saskatchewan, 120 known release sites were monitored during 2003 (Table1).

The number of years after release varied from two to 16 years. The percentage of area, approximately 20 x 20 m around the release point, covered with leafy spurge was estimated. The cover of leafy spurge on a release site when a release was made is unknown. When the release point was not marked by a stake, a GPS (Global Positioning System) reading was use to approximated the release point. Percent grazing loss was estimated from North Dakota research that developed the formula: CC = 100 – 1.25(PI). In the formula, CC = percentage of carrying capacity and PI = percent of land covered by leafy spurge. The presence of beetles on a site was recorded as the number of beetles per sweep with a common 36 cm diameter sweep net. The percent sample and the number of samples in the arbitrarily selected leafy spurge cover categories: 0, 1 – 10, 15,

Table 1: Cover of leafy spurge on beetle release sites

Years After Release	Leafy Spurge Cover %	% Grazing Loss	Beetles /Sweep	Percent Samples	Number of Samples
2 - 16	0	0	1	5%	6
2 - 16	1 - 10	1 - 13	4	17%	20
2 - 16	15	19	10	12%	14
2 - 16	20	25	8	10%	12
2 - 16	21 - 40	26 - 50	7	26%	31
2 - 16	41 - 100	51 - 100	5	31%	37
			Total Number of Samples		120

20, 21 – 40 and 41 100 was calculated.

In five per cent of the samples, the number of beetles per sweep was very low and there was no visible leafy spurge on the site (Table 1). On some sites, careful inspection found a few very small plants and a few beetles. In a small number of cases, with ideal circumstances, leafy spurge suppression was excellent.

On 34% (5% + 17% + 12%) of the samples, the cover of leafy spurge was 15% or less and the loss of grazing carrying capacity was 19% or less (Table 2). For a pasture which is covered by 19% leafy spurge, a land owner or operator would set grazing at 81% of carrying capacity. On these sites, circumstances are less than ideal for the beetles to suppress leafy spurge to an insignificant plant in the vegetation. The amount of further cover reduction, if any, is unknown. What is known is the beetles will continue to feed on leafy spurge roots, which will damage and stress the plant.

For a area with a large number of acres of leafy spurge, beetles are the most effective economical choice. The only expense associated with beetles is a $40 sweep net, travel and time, to collect and release. Control is better with herbicides, but there is an on-going cost for herbicide treatments that include the cost for the herbicide and its application. Mowing once or twice a year is not only expensive, but often impractical because of rough topography. Sheep effectively control leafy spurge while providing an income, but ranchers must become sheep herders.

The best method for controlling leafy spurge is to integrate leafy spurge beetles with herbicide treatments, mowing, multi-species grazing and sheep grazing.

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A Detailed Management Plan to Stop Weed Spread

By Garry Bowes – Noxious Weed Program

Often there are limited resources available to control large areas of our most aggressive weeds. In Saskatchewan, noxious weeds such as field bindweed, leafy spurge, scentless chamomile and yellow toadflax are expensive to control and when they are found in large areas, eradication is most likely impossible.

Spotted knapweed is a relatively new weed in Saskatchewan but has been known to grow in Montana since at least 1920. In Saskatchewan, the weed is known to grow on six sites, which occupy less than one acre each. Two locations are in Regina, locations have been found in the Rockglen area, Chaplin, Caronport and one was recently reported by U.S. border agents moving north on Highway #2. Eradication measures are underway in these locations, but other populations may be present and go unnoticed without ongoing monitoring. Several patches have already been found and eradicated along the rail line running from Gull Lake to the Alberta border over the last 20 years by a weed inspector with a program. In Montana, spotted knapweed infests more than 4.5 million acres and has a $45 million (US dollars 2002) annual impact on cattle producers. The weed has the potential to invade another 34 million acres in the state. In Saskatchewan, be proactive and stop weed establishment and spread.

A new publication by the Center for Invasive Plant Management in Bozeman, Montana, suggests that limited resources might be spent more efficiently on proactive weed management that focuses on controlling existing infestations along with prevention and early detection of new invasions. What 'jumps out' is the low cost of being proactive by paying attention to many details, which is necessary to stop weed spread. The alternative is to react to large areas with established noxious weeds, which usually means on-going control, most likely with expensive herbicides.

Often industrial land provides an opportunity for weeds to establish. Transportation corridors, equipment storage areas and industrial building sites are examples of industrial land that is common in the province. These sites are vulnerable for weed establishment because there is on-going vehicle and equipment movement, which provides a method of entrance for hitch-hiking seed. Also, industrial activities often disturb the established vegetation, which may bare the ground surface. Bare ground makes a good habitat for weed seed germination and seedling development. Seeds can be present at a disturbed site or in the future seed may hitch a ride to a disturbed site.

General principles for a successful weed prevention plan:

- Limit the introduction of weed seeds to industrial land.
- Scout for small patches of weeds, and when found, quickly attempt eradication.
- Always minimize the disturbance of established vegetation.
- Manage industrial land to maintain healthy plants to compete with weeds.
- Look for weeds on high risk areas such as transportation corridors.
- Always seed desirable plants into disturbed sites in such a way as to promote its rapid establishment (i.e. use high quality certified weed-free seed, good seed placement and control competing weed seedlings).
- Annually, evaluate the prevention plan and implement changes when necessary.

Keep these principles in mind when planning any project that will disturb established vegetation and result in bare ground. New road construction rights-of-ways, road reconstruction rights-of-ways, land used for equipment storage and unused industrial land are examples of parcels of land where bare ground should always be re-vegetated or covered with an impermeable base to prevent weed invasion.

Do a risk assessment analysis for weeds before starting any project that involves the disturbance of vegetation that will expose bare ground. The longer bare ground is exposed the higher the risk for weed invasion and establishment. Perennial weeds such as leafy spurge and yellow toadflax, that dominate vegetation are high risk for establishment. If these weeds grow on a project site, there is a high risk for spread outside the project area and if they grow near the project site there is a high risk for invasion into the project site. High-risk weeds are those that are designated noxious; plants that are known to be invasive or plants that produce seed which can remain viable in soil for up to 10 years or more.

Before a project starts, complete a weed risk assessment for each parcel of industrial land:

- Do an inventory for weeds before starting the ground disturbing part of a project.
- Avoid or remove sources of weed seeds or other propagules to prevent spread.
- Plan to control weeds three to five years before vegetation disturbance to minimize seed in the soil seed bank and reduce reproducing vegetative plant parts.
- Restrict the movement of equipment from weed-contaminated to non-contaminated areas. This is most important when seed is ripe and when plants have not shed ripe seed.
- Locate and use weed-free sites for project staging areas.
- Require all equipment that will be used in a project to be cleaned free of weeds before entry to a project site. Before a project starts, designated sites for cleaning equipment that is suspect of transporting weed seeds or propagules. After cleaning, collect and incinerate plant parts. Scout the cleaning area for the appearance of weeds during the project and for several years after the project is completed.
- Clean all equipment in the designated site before leaving a project site when the site harbours high-risk weeds.
- Properly dispose of weed seeds and plant parts by collecting, bagging and incinerating.

During the operational part of a project, prevent the introduction of new invasive weeds and the spread of weeds known to grow in isolated sites on the project area.

- Inspect sites for materials, such as sand, gravel and fill that will be transported and used at the project site, to ensure that weed-free materials are used.
- On sites for materials, which are known to harbour high-risk weeds, strip and stockpile contaminated material before transporting material which is low risk for weeds. At the project site, scout for weeds for several years after the project is completed.
- Stockpile non-weed infested material and maintain weed-free for use in areas where high-risk weeds can not be tolerated.
- Avoid unnecessary disturbances that leave the ground bare, by retaining the established vegetation intact as much as possible.

After a project has been completed and all bare ground has been vegetated, promote weed prevention through awareness and education. Always keep a file in the office on the identification and control of the weeds that are a potential threat to project sites.

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Good Record Keeping is a Necessity For this generation and the next!

Garry Bowes / Noxious Weed Program

As a part of their ongoing enforcement and monitoring activities, Weed Inspectors should keep a ***permanent*** record of the location of noxious weeds and document the effectiveness of the weed control measures that are used. To stop the rapid spread of a noxious weed, it should never be allowed to set seed.

Weed Inspectors can use the Record of Noxious Weed Control form, which is shown in Figure 1, as a guideline for the information that should be recorded when a noxious weed is first found, treated for control and monitored for effective control. This record sheet supports the proactive approach of stopping the spread of noxious weeds. The proactive approach is a continuous cycle of scouting, treating and monitoring for performance.

The Record of Noxious Weed Control does not replace the requirement for herbicide application information that is mandatory in the *Pest Control Products Regulations, 1995* of the *Pest Control Products (Saskatchewan) Act* (PCP Act). Parts 1 and 2 of Section 23 of the Regulations are presented in Figure 2. Also, the Record of Noxious Weed Control does not replace an Agreement or Order that is part of the Regulations of *The Noxious Weeds Act, 1984*.

RECORD OF NOXIOUS WEED CONTROL

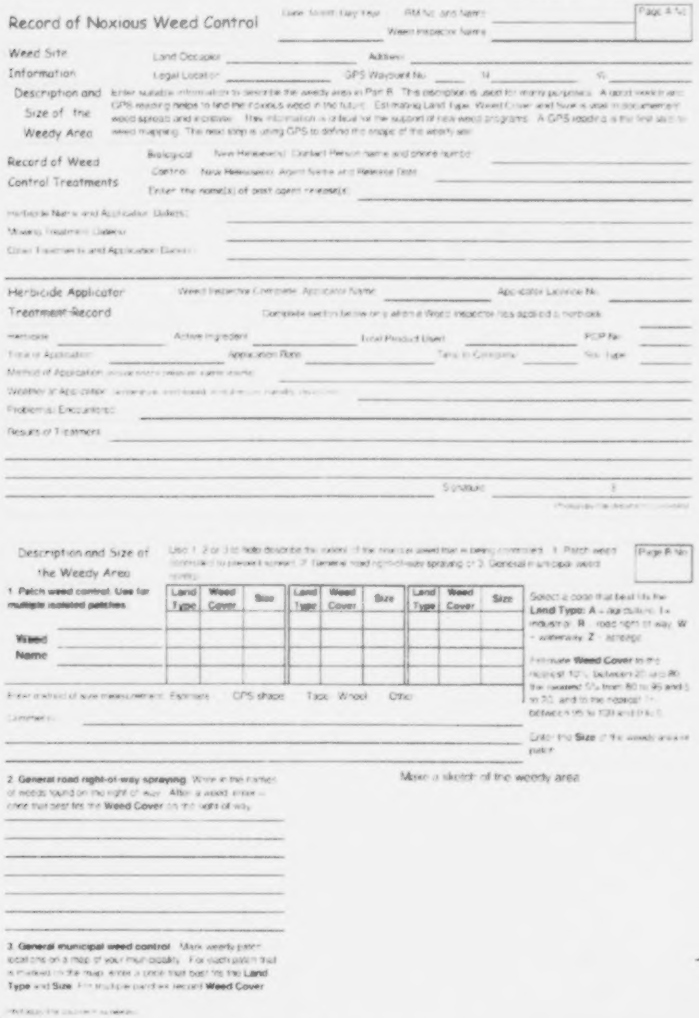
The Record of Noxious Weed Control form is a two-page document that was designed to help Weed Inspectors keep a record of weed locations and an on-going record of the types of treatments that were used for control. This is critical for the changeover of information from one weed inspector to the next in a municipality. In future years, a new weed inspector can revisit this document to evaluate treatment performance and noxious weed spread. In the event of a legal dispute that could arise from non-chemical related activities, good on-going records are good evidence.

WEED SITE INFORMATION

Site information on the location of noxious weeds should be collected and recorded by a Weed Inspector and is the property of a municipality. Site information allows a municipality to quickly identify the owner of a property with a noxious weed. A legal location and a Global Position System (GPS) navigation receiver reading allow anyone to quickly and easily find a noxious weed infestation in a municipality.

DESCRIPTION AND SIZE OF THE WEEDY AREA

To evaluate the effectiveness of a control program, it is important to determine if a treated weed infestation is expanding or the weed is being controlled. Record the land type, weed cover and size of the weed infested area when a noxious weed is first found. Similar information can be recorded



Record of Noxious Weed Control

Date: Month Day Year ______ RM No. and Name ______ Page A No.

Weed Inspector Name ______

Weed Site Information

Land Occupier ______ Address ______

Legal Location ______ GPS Waypoint No. ____ N ______ W ______

Description and Size of the Weedy Area

Enter suitable information to describe the weedy area in Part B. This description is used for many purposes. A good sketch and GPS reading helps to find the noxious weed in the future. Estimating Land Type, Weed Cover and Size is used in documenting weed spread and increase. This information is critical for the support of new weed programs. A GPS reading is the first step to weed mapping. The next step is using GPS to define the shape of the weedy area.

Record of Weed Control Treatments

Biological Control

New Release(s): Contact Person name and phone number ______

New Release(s): Agent Name and Release Date ______

Enter the name(s) of past agent release(s) ______

Herbicide Name and Application Date(s): ______

Mowing Treatment Date(s): ______

Other Treatments and Application Date(s): ______

Herbicide Applicator Treatment Record

Weed Inspector Complete: Applicator Name ______ Applicator Licence No. ______

Complete section below only when a Weed Inspector has applied a herbicide

Herbicide ______ Active Ingredient ______ Total Product Used ______ PCP No. ______

Time of Application ______ Application Rate ______ Tank [illegible] ______ Soil Type ______

Method of Application [illegible] ______

Weather at Application [illegible] ______

Problem(s) Encountered: ______

Results of Treatment ______

Signature ______

Description and Size of the Weedy Area

Use 1, 2 or 3 to help describe the extent of the noxious weed that is being controlled: 1. Patch weed controlled to prevent spread, 2. General road right-of-way spraying or 3. General municipal weed control.

Page B No.

1. Patch weed control. Use for multiple isolated patches.

Weed Name

Land Type	Weed Cover	Size	Land Type	Weed Cover	Size	Land Type	Weed Cover	Size

Select a code that best fits the **Land Type: A** = agriculture, **I** = industrial, **R** = road right of way, **W** = waterway, **Z** = acreage

Estimate **Weed Cover** to the nearest 10% between 20 and 80, the nearest 5% from 80 to 95 and 5 to 20, and to the nearest 1% between 95 to 100 and 0 to 5.

Enter the **Size** of the weedy area or patch.

Enter method of size measurement: Estimate GPS shape Tape Wheel Other

Comments ______

2. General road right-of-way spraying. Write in the names of weeds found on the right of way. After a weed, enter a code that best fits the **Weed Cover** on the right of way.

Make a sketch of the weedy area

3. General municipal weed control. Mark weedy patch locations on a map of your municipality. For each patch that is marked on the map, enter a code that best fits the **Land Type** and **Size**. For multiple patches record **Weed Cover**.

Figure 1.

Information that needs to be recorded when a noxious weed is found and treated.

for sites with noxious weeds that are presently being treated. In the future, re-evaluate your estimate for land type, weed cover and size of the weed infested area and then compare the new record to the old records. The difference is either weed control or weed spread. For an accurate estimate of weed control or spread over time, complete information for land type, weed cover and size will be needed.

For **Land Type** select the code (A = agriculture, I = industrial, R = road right-of-way, W = waterway or floodplain, Z = acreage) that best fits the area of weed infestation. After several years, **Land Type** may explain how a weed spreads. A noxious weed may first appear along a road right-of-way and then in a crop field.

Within an infested area, for **Weed Cover,** record the percent weed cover (estimate to the nearest 10% between 20 and 80, the nearest 5% from 80 to 95 or 5 to 20, and to the nearest 1% between 95 to 100 and 0 to 5) that best estimates the cover of the noxious weed on the soil surface. An increase in **Weed Cover** means the noxious weed is slowly dominating the infested area. A decrease in **Weed Cover** means weed control.

The **Size** of a weed infested area can be estimated or measured. An increase in the **Size** of an infested area indicates weed spread.

When a noxious weed in a treated area is expanding by either increasing **Weed Cover** or **Size**, then it is time to re-evaluate the treatment method and make appropriate changes.

On the Record of Noxious Weed Control form use **Patch weed control** when an isolated weed patch is found. Also, use this section when a few weed patches are found in an area.

When a large portion of a road right-of-way is infested with noxious weeds and the right-of-way needs to be treated, enter information for the right-of-way in the section **General road right-of-way spraying**. For effective weed control, **Weed Cover** should decrease.

When there are many noxious weed patches scattered throughout a municipality, mark the locations of the patches and their GPS readings on a municipal map and use the **General municipal weed control** section. Information for **Land Type, Weed Cover** and **Size** can be recorded on the municipal map. Complete information will be needed to find out if there is weed control or spread.

RECORD OF WEED CONTROL TREATMENTS

Record the number, type and time of noxious weed control treatments. If after several years, the noxious weed is spreading, then the treatment or treatments should be changed.

Figure 2.
Record keeping required by a licensed pesticide applicator after a pesticide application.

23(1) Every holder of a pesticide applicator licence or a pesticide service licence shall keep records on a daily basis of each operation he or she performs thatinvolves pesticide use or application, on forms provided by or acceptable to the department, that must include:

(a) the name of the person for whom the pesticide was applied;
(b) the location and size of the area where the pesticide was applied;
(c) the year, month, day and time at which the pesticide was applied;
(d) the purpose for which the pesticide was applied;
(e) the common or product name of the pesticide applied and the registration number assigned to it pursuant to the federal Act;
(f) the method of application;
(g) the total quantity of or the rate of application of the pesticide applied;
(h) the quantity and method of disposal of surplus pesticide containers;
(i) the details of remedial measures taken to respond to pesticide spills or of the clean up of pesticide spills; and
(j) meteorological data at the time the pesticide was applied.

HERBICIDE APPLICATOR TREATMENT RECORD

There are two parts in the Herbicide Applicator Treatment Record. A Weed Inspector need only complete part of the section that records the applicator name and license number when a control treatment is contracted to an applicator, but he may want to get some of the application details from the applicator for an evaluation of weed control. When a Weed Inspector has a pesticide applicator licence and is the herbicide applicator then completion of the remainder of this section is more critical. While some of the information requested on the Record of Noxious Weed Control form is similar to the information required in the PCP Act, licensed applicators should always consult the regulations of the PCP Act for legal record keeping requirements. This is important when a Weed Inspector assumes the role of the applicator for the municipality and makes herbicide applications.

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Chilly Reception for Biological Control Agents

Garry Bowes
Noxious Weed Program

A cool June in 2004 has slowed the appearance of biological control agents for leafy spurge and scentless chamomile.

Leafy Spurge

Black Spurge Flea Beetle

The two most common agents for the control of leafy spurge are the Black Dot Spurge Flea Beetle (*Aphthona nigriscutis*) and the Black Spurge Flea Beetle (*A. lacertosa*). The larvae of these beetles damage leafy spurge by feeding on roots.

While the growth of leafy spurge during 2004 was excellent, the beetles did not appear until the third weed in July which is three weeks later than last year. Also, the number of beetles captured in a sweep net this year is less than number recorded for last year. The development of the life cycle of the flea beetle is closely related to Growing Degree Days (GDD). The lower number of GDD this year compared to the numbers recorded for the past warm-dry summers is thought to account for the slow emergence of the adult flea beetles.

Collectors of flea beetles for release should expect to find fewer beetles per sweep in their sweep net. Beetle numbers vary by site but during the third weed in June the number captured in an hour by a sweeper ranged from 2,000 to 5,000.

Scentless Chamomile

Scentless Chamomile Seed Weevil The development of scentless chamomile plants was delayed in 2004. On many plants the first flower bud did not open until the third week in June. The larva stage of the scentless chamomile seed weevil (*Omphalapion hookeri*) damages the noxious weed by eating florets and developing seeds. Adult weevils over winter in the soil, emerge in the spring and feed on the new growth of scentless chamomile.

The number of winter annual scentless chamomile plants that bolted this spring was low. Last fall was dry, which resulted in few rosettes. Good spring moisture resulted in the vigorous growth of a large number of spring annual scentless chamomile plants which tend to flower later than the winter annuals. Therefore, during the third week in July, there were many scentless chamomile plants but only a few had started to flower.

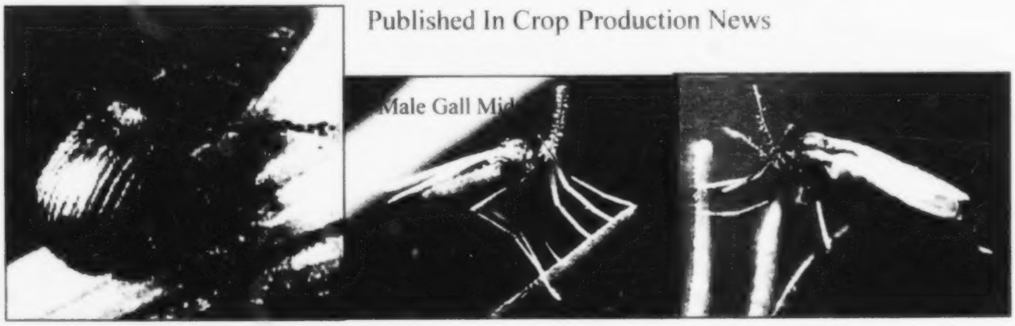
When the flower bud appears through the sepals of the calyx, adults lay eggs in the flower bud. This year during the cool June days, seed weevils could not be found near flower bud before they opened. When the flower buds opened, the number of weevils found laying eggs was low, compared to previous years.

Scentless Chamomile Gall Midge

The gall midge (*Rhopalomyia tripleurospermi*) attacks scentless chamomile causing the formation of a gall. This agent over winters in galls that form on rosettes. In the spring, adults emerge from galls and attack new plants. Gall midges change the architecture of the noxious weed by reducing plant height.

This spring, healthy scentless chamomile rosettes with galls were found at the Canwood collection site. These plants were dug up and transplanted around the City of Yorkton. Yorkton is a good collection area for seed weevils and with the addition of gall midges it is hope that the city will become a major collection area for both species.

Harvesting of scentless chamomile rosettes, including those with galls, by grasshoppers last fall is a major concern. It is thought that when grasshoppers consume all of the scentless chamomile plants at a release site, the gall midge population could be devastated. High grasshopper numbers were observed at gall midge release sites near Coleville, Lang and Luseland, SK. An inspection of sites near Lang found no galls on scentless chamomile plants. While this is alarming, galls are more difficult to find in the summer than late fall. This fall, sites at all three location will be visited and inspected for galls.



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P. Harris, AAFC

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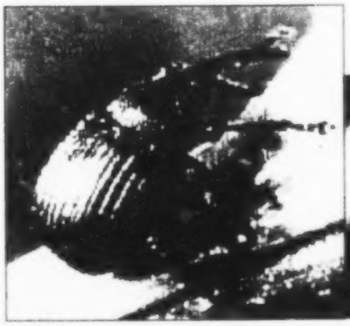
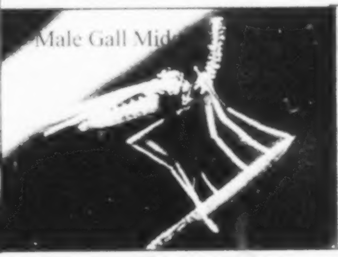
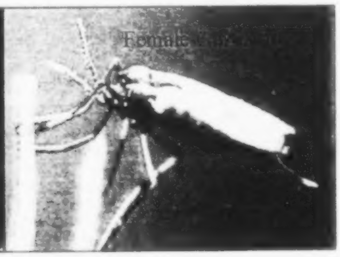






Scentless Chamomile Seed Weevil Collection and Re-Distribution

Garry Bowes, Noxious Weed Program

The seed weevil is a biological control agent that reduces the number of seeds that a scentless chamomile plant can produce. Weevils eat the florets and immature seeds in the flower-seed heads of scentless chamomile. One seed weevil eats about 11 scentless chamomile seeds.

Seed weevils travel short distances to find new patches of scentless chamomile. Over ten years, seed weevils have moved 15 km. Look at the map which shows the seed weevil release sites in the province to find out if they have travelled to your area. If the weevil is not known to reside near your home and scentless chamomile grows in your area, then it is time to travel to an area with seed weevils, collect them and release them close to home.

Seed weevils can be collected from sites where they have successfully established and released in area where they are not known to inhabit. There are 116 known scentless chamomile weevil release sites in the province. Each year, some sites are monitored to find out their suitability for weevil collection. Release site information is available from Garry Bowes at 933-7695.

If you are interested in establishing seed weevils in your area, first obtain a list of sites from the Garry Bowes and then phone the landowner of an area for permission to collect. A GPS navigation receiver will most likely be needed to quickly and easily find a collection site.

Seed weevils can be collected in the field during June or August.

JUNE SEED WEEVIL COLLECTION

Seed weevils can be collected during June when the flower buds start to open on scentless chamomile plants. Figure 2 shows the open flower bud stage that is best for weevil collection. Use an artist print brush to brush the weevils off the scentless chamomile and in to a collection container. The collection container cannot be left unsupervised because the adults are very active and will escape. Place small sprigs of scentless chamomile leaves in the collection container to slow the escape of seed weevils. Old plastic pill bottles, margarine or honey containers are good collection containers. Make small holes in the top of the containers for air exchange or cover with a piece of nylon stalking and elastic.

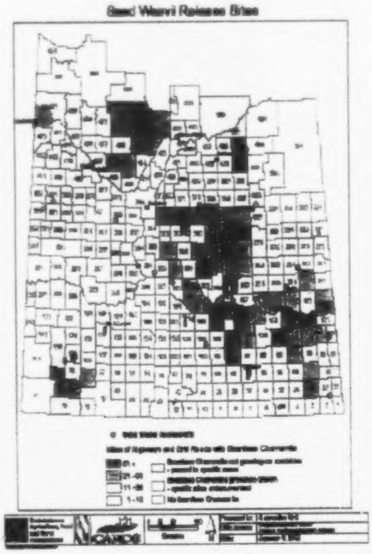
This is the most accurate method for collecting seed weevils because the number of adults is known.

From the latter part of July to the first part of August, maturing seed heads, containing weevils, can be collected from a location that is known to harbour seed weevils and moved to a new location. Before starting to collect, sample 40 scentless chamomile seed heads for adult weevils when the seed heads are changing colour from dark yellow to brown. A good sample should contain seed heads from all over the collection site. The purpose of a sample is to avoid collecting uninfested seed heads. Use a pair of sharp scissors or a knife to cut open a seed head. Figure 3 shows the location of adult weevils in a flower head. **A site is suitable for collection when the seed weevils are present in over 50% of 40 randomly sampled seed heads.**

A good collection site can average three adult seed weevils per seed head.

This collection and release method allows the seed weevils to emerge on-site. The disadvantage with this method is the actual number of adult seed weevils released is unknown. Also, cool, wet weather after a release will have a negative impact on the viability of the release population, as adults will not be as likely to emerge and may eventually die in the seed head.

Sites that are suitable for weevil release should have a vigorous stand of scentless chamomile with plenty of flower buds. A release of a 100 seed weevils is sufficient for successful establishment. Use the 40-seed head sample to determine the number of seed heads that should be collected. Use scissors to cut the entire seed head from the plant. Place the seed head in a hardware grade paper bag. When the collection is complete, fold the top of the paper bag over, staple shut and secure with duck tape for transport to the new location.



TIPS FOR SUCCESSFUL ESTABLISHMENT

Releasing a larger number of seed weevils will increase your chance for a successful establishment.

Regardless of the release option selected, release the seed weevils as soon as possible after they are collected. If this is not possible due to weather conditions or travel, the insects can be stored in a cooler with ice packs, or in a fridge. Under these conditions, it is critical that the temperature in the cooler does not fall below 4°C.

Ambient temperature is an important factor to consider when making a release. Temperatures above 28°C can dramatically increase mortality; therefore transport the seed weevils to the release site in a cooler with ice packs and release in the evening. Conversely, cool temperatures (<18°C) are not beneficial for a release, as the seed weevils will not be sufficiently active.

SELECTING THE RELEASE SITE

Release the seed weevils at a site were scentless chamomile can be left undisturbed for 3 to 5 years. Do not release seed weevils near anthills or wasp nests.

HOW TO RELEASE SEED WEEVILS

Release the insects near the centre of a scentless chamomile stand. To release the insects, place the opened shipping container on the ground near the stake and leave undisturbed for 10-15 minutes. This allows the insects to adjust to their new environment before they exit the container. This is important if the insects were in a fridge or a chilled cooler immediately before release. Gently shake the remaining insects out within 1-3 metres of the release point. This distribution lessens the risk of mortality from predacious insects.

Mark the release location with a clearly visible stake. Fill out a release form with the directions so others can find the release location. A GPS reading is important to positively identify a release location.

It is important to maintain good records on biological control releases. A release record can be kept in the noxious weed files at the RM or town office and a copy of the release record should be forwarded to Garry Bowes or Clark Brenzil, Provincial Weed Control Specialist, for inclusion in the provincial record for use by projects such as the Noxious Weed Program.

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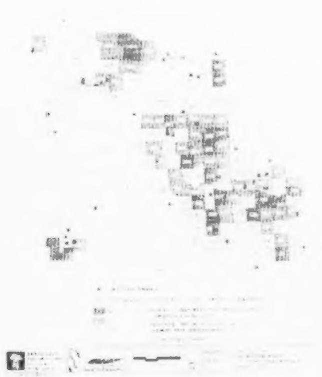
Scentless Chamomile Gall Midge Collection and Re-Distribution

By Garry Bowes, Noxious Weed Program

The scentless chamomile gall midge is a biological control agent for scentless chamomile. The larvae of the gall midge feed on the growing points, leaf axils and flower buds of scentless chamomile, causing the plant tissue swell into a gall. Galls stunt growth by changing the architecture of the plant. Gall midges spread at a rate of 5.2 km per year.

The distribution of the 116 known gall midge release sites in the province is shown in Figure 1.

Figure 1. Gall midge release sites in Saskatchewan



Each year, there are two and in some years three generations of the gall midges. The life cycle of the gall midge is shown in Figure 2. The gall midge over winters in galls that form in the fall on scentless chamomile rosettes. Figure 3 shows a gall on a scentless chamomile plant in the rosette stage. In the spring, adult midges emerge from galls, lay eggs on the growing points of scentless chamomile plants. The eggs hatch larvae which feed on the plant causing the formation of a gall. It takes about thirteen days from the exposure of a scentless chamomile plant to an egg-laying gall midge before a gall is visible. It takes about 35 days for a gall midge to complete a generation. For Generation – 1, galls appear in late May to mid-June with adults emerging in early July. Figure 4 shows where to look for a gall on a scentless chamomile plant in June (left) and how visible these galls are in the fall (right). Most likely this is a Generation – 1 gall and the adults exited from the gall in July. For Generation – 2, galls appear in late July with adults emerging by late August to mid-September. In mid-September, galls appear on scentless chamomile rosettes, which form the Overwinter Generation. Figure 3 shows a typical gall in the fall of the year.

Figure 2. Gall midge life cycle

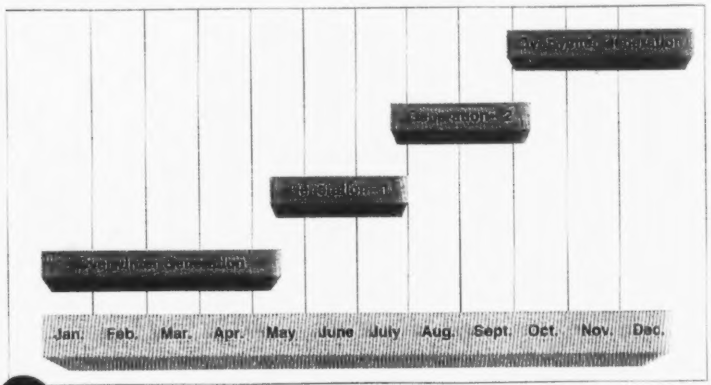
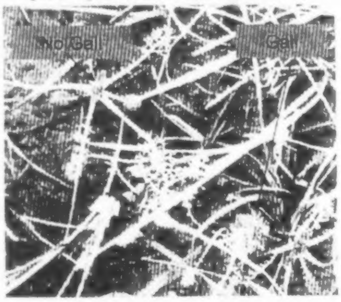


Figure 3. A gall on a rosette of scentless chamomile



Gall midges can be introduced into new sites by transplanting scentless chamomile plants with visible galls. In Alberta, the success of transplanted scentless chamomile plants was 92% up to mid-July and 60% for releases made between mid-August to the early September. In an area with a dry fall and spring, the overwinter survival of field scentless chamomile plants with galls was 48%. When vigorous greenhouse grown plants were transplants into a field, there was no overwintering mortality. This suggests that it may be better to transplant vigorous scentless chamomile which are often found when fall and early spring moisture is above normal.

GALL MIDGE RELEASE FROM SCREEN CAGES

In the early spring rosettes of scentless chamomile can be transplanted into 10-cm square plastic pots which are placed in 20-mesh per inch screened cages. These plants are exposed to egg-laying gall midges and when the galls appear, transplant 9 plants, in a 1 x 1 metre grid, in the field with scentless chamomile. Water the transplants when necessary.

EARLY SPRING GALL MIDGE FIELD COLLECTION

In the spring after the soil has thawed but before growth has started, dig up 12 scentless chamomile plants that are growing with galls on rosettes. Wrap the plants in paper towel, wet thoroughly, place the wrapped plants in a plastic bag for transport and transplant these plants in an area with scentless chamomile. Spring is thought to be the best time to successfully transplant scentless chamomile but rosettes with galls are difficult to visually locate in the spring.

LATE FALL GALL MIDGE FIELD COLLECTION

In the fall after a killing frost but before freeze-up, dig up 12 scentless chamomile plants, growing in the rosette stage with galls as is shown in Figure 3. Wrap the plants in paper towel, wet thoroughly, place the wrapped plants in a plastic bag for transport and transplant in an area with scentless chamomile. Fall is the best time to find scentless chamomile rosettes with galls.

TYPE OF DAMAGE CAUSED BY GALL MIDGE

The damage caused by galls on scentless chamomile is documented by a few experiments that were conducted on scentless chamomile plants that were growing in an non-competitive environment and when field conditions were dryer than normal. The affect that gall midges have on scentless chamomile when field conditions are wetter than normal is unknown. In the spring, gall midges attack the terminal bud on scentless chamomile plants, causing stunted growth and delayed flower development. Plant height was reduced 5% and flower number per plant was reduced 37%. In another experiment, vigorous greenhouse grown rosettes of scentless chamomile were transplanted in to the field in the fall. The following spring, galled plants produced 97% more bolting stems which were 26% shorter than non-galled plants. Plant weight and flower number were similar on galled and non-galled plants. The damage caused by the gall midge on plants that are growing in competition with vegetation is unknown.

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Financial support for The Noxious Weed Program has been provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada. ■

Using Sheep for Leafy Spurge Control

Garry Bowes
Noxious Weed Program

Sheep will graze leafy spurge and are often used for long term control of the noxious weed. Sheep grazing stresses leafy spurge. Seed production is reduced and over time the density of the weed is reduced.

In their text book, Rangeland Ecology & Management, Harold Heady and Dennis Child discuss the distribution of seed by animals. Seed can be passively transported by animal fur. Viable seed can pass through the digestive tracts of animals. One autopsied sheep has 1,559 seeds in the digestive tract and sheep in Idaho retained viable seed for 9 days. Recent research at Montana State University gives a good understanding of how sheep can spread seeds of leafy spurge.

In an experiment in south western Montana, yearling Targhee sheep were twice rotated through paddocks that contained leafy spurge.

In October, the sheep were shorn and leafy spurge seed was recovered from the fleeces.

Table 1. Leafy spurge seed recovered from sheep manure[*]

Date	Seeds/Animal/Day	% Germinated and Viable Seeds
Collection 1, sheep entered paddock June 27		
30 June	41	0
8 July	88	9
13 July	46	0
Collection 2, sheep entered paddock July 14		
17 July	144	7
25 July	114	17
Collection 3, sheep entered paddock July 29		
31 July	41	8
8 Aug	41	0

[*]Adapted from Olson et al. 1997 JRM 50:10-15

In the same experiment, fresh manure was collected 4, 10 and 14 days after sheep entered a paddock. The manure was dried and washed over sieves to recover leafy spurge seeds. Seeds were counted and tested for germination. Seed that germinated and are viable were added and presented as % Germinated and Viable Seeds in Table 1. Seeds that did not germinate but tested positive in a viability test are viable seed. Viable seed can germinate in the future. Seeds of leafy spurge are known to remain viable in soil for up to 8 years.

Table 1 shows that manure collected from an animal each day contained leafy spurge seeds during the first, second and third collection periods. Up to 144 seeds were excreted daily by sheep. The number of viable seeds that were excreted daily per animal ranged between 0 and 17.

Before the sheep entered a paddock, seeds were collected from the leafy spurge stems and tested for viability. The percentage of viable leafy spurge seed in manure was always lower than for seeds collected from leafy spurge stems.

Sheep grazing rangeland infested with leafy spurge may pick up seeds in their fleece. At the end of the experiment, the sheep were shorn and leafy spurge seeds were recovered from the fleeces.

Table 2 shows that three fleeces contained leafy spurge seeds and three did not. The authors believed that the crimped nature of wool would cause seeds to adhere to the wool fibres and become embedded. Seed may drop before becoming embedded but once embedded, seeds would most likely fall out during shearing and processing.

Table 2. Leafy spurge seed recovered from fleeces

Sheep Number	Fleece wt. kg	Seeds in Fleece
1	2.7	0
2	2.6	129
3	2.7	0
4	2.7	29
5	3.1	0
6	2.4	74

[*]Adapted from Olson et al. 1997 JRM 50: 10-15

In a second experiment, sheep were fed leafy spurge seeds at the soft dough, hard dough and mature stages of development. Leafy spurge seeds were collected in capsules.

Leafy spurge seeds develop in a tri-lobed capsule with three seeds as shown in Figure 1. Seeds in the soft dough stage remained in capsules, were immature and the capsules were easily cut by a fingernail. Also, seeds in the hard dough stage remained in capsules and the capsules were hard and difficult to cut by a fingernail. Mature seeds were obtained from fully developed capsules.

Leafy spurge seeds at the three stages were fed to sheep and manure was collected every 24 hours for 5 days. Seeds was recovered from the manure, counted and tested for germination. In Table 3, seeds that germinated were added to seeds that were viable and called % Germinated and Viable Seeds. All seeds that were classed as viable were tested for seed viability.

In the field, all leafy spurge seed does not mature at the same time. Soft dough seeds collected on June 24th had 25% mature seed. Hard dough seeds collected on July 19th had 80% mature seed. Mature seeds collected on August 10 were 100% mature.

Soft dough stage seeds in manure did not germinate and were not viable. Some hard dough and mature seeds in manure were viable. One day after feeding hard dough seeds, 4 immature and 16 mature seeds were collected from manure. Forty one percent of these seeds either germinated or were viable.

A small percentage of seeds pass through the digestive tract. More seeds from the later than the earlier fed seeds passed through the digestive tract. The percentage of soft dough seed recovered was 0.2% compared to 3.8% of the mature seed.

CONCLUSIONS

When leafy spurge is in flower, take a close look at the flowers for capsules that contain seeds. In the field, seeds of leafy spurge do not flower at the same time. Look for the capsule that is first formed, usually in the center of the flower. Use the fingernail test to determine the stage of seed development. If the seeds are in the soft dough stage then according to the latest research they will not germinate and are not viable. If seeds are in the hard dough stage or are mature then some seeds eaten by sheep will pass through the digestive tract and are viable.

RECOMMENDATIONS

When sheep graze leafy spurge that has not flowered then there is no seed to pass through the digestive tract or move in fleece.

Seeds of leafy spurge that are consumed and passed through the digestive tract may enhance the dispersal of the weed.

When sheep are grazing leafy spurge with seed in the hard dough stage or is mature, do not move sheep from an infested site to a leafy spurge free site until the animals are confined and fed clean feed for 5 days.

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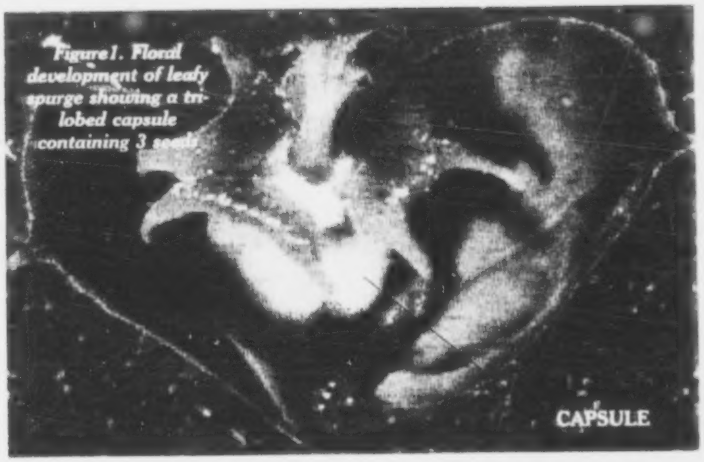
Figure1. Floral development of leafy spurge showing a tri-lobed capsule containing 3 seeds

Table 3. The capability of leafy spurge seed to germinate after passing through the digestive tract of sheep[1]

Stage of Leafy Spurge Fed to Sheep	Days After Feeding	Immature Seeds	Mature Seeds	% Germinated and Viable Seeds
Soft Dough Stage • 0.2% of the fed seed was recovered	1	7	2	0
	2	1	1	0
	3	2	1	0
	4	0	0	0
	5	0	1	0
Hard Dough Stage • 1.5% of the fed seed was recovered	1	4	16	41
	2	1	7	0
	3	0	3	0
	4	1	2	10
	5	0	0	0
Mature Seed • 3.8% of the fed seed was recovered	1	0	24	81
	2	0	71	36
	3	0	10	0
	4	0	3	0
	5	0	1	0

[1] *Adapted from Olson and Wallander JRM 2002 55: 65-69*

seed. Mature seeds collected on August 10 were 100% mature.

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When leafy spurge is in flower, take a close look at the flowers for capsules that contain seeds. In the field, seeds of leafy spurge do not flower at the same time. Look for the capsule that is first formed, usually in the center of the flower. Use the fingernail test to determine the stage of seed development. If the seeds are in the soft dough stage then according to the latest research they will not germinate and are not viable. If seeds are in the hard dough stage or are mature then some seeds eaten by sheep will pass through the digestive tract and are viable.

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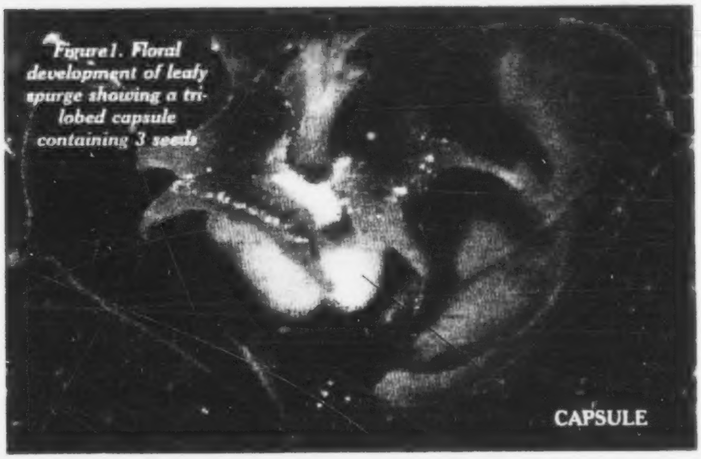
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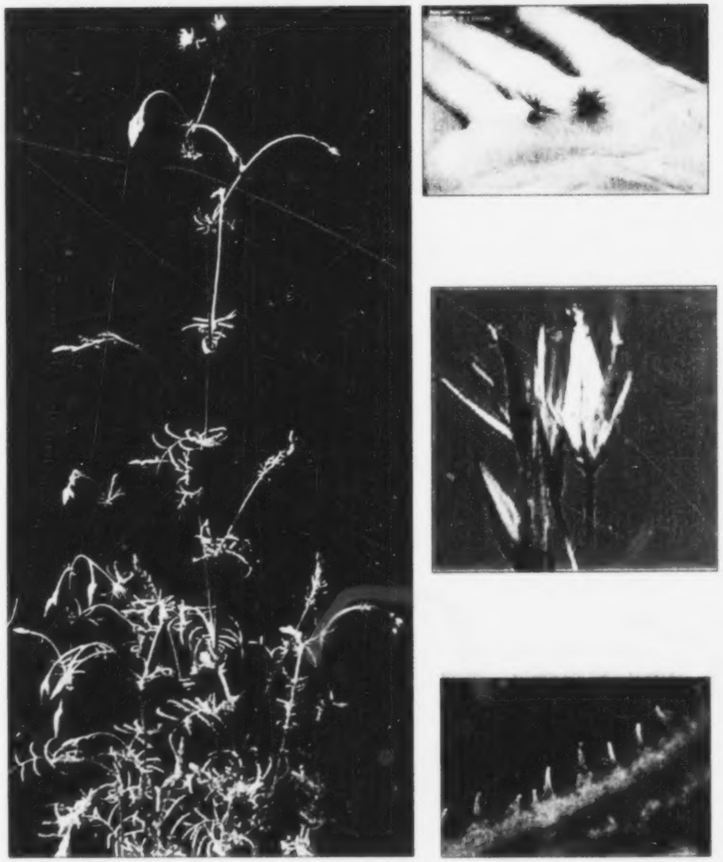
	3	0	3	0
	4	1	2	10
	5	0	0	0
Mature Seed • 3.8% of the fed seed was recovered	1	0	24	81
	2	0	71	36
	3	0	10	0
	4	0	3	0
	5	0	1	0

[a] *Adapted from Olson and Wallander JRM 2002 55: 65-69*

Common Crupina (*Crupina vulgaris*)



- **Identification**
- Pink flowers with knapweed-like flowers
- Deeply divided leaves with Velcro-like hooks on the leaf edge
- Very large seeds (1/4 inch long) with black fringe of hairs (~1/2 inch in diameter)

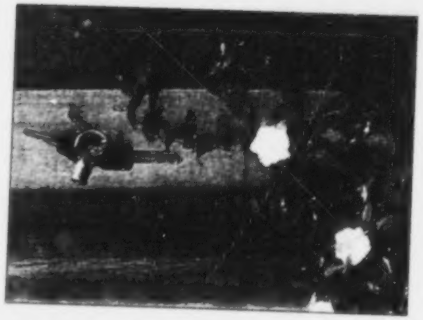
- **Biology and Ecology**
- Reproduces only by seed

Location

- Established in Idaho, California, Oregon, and Washington. Not known in Canada.

Report to SAFRR if found.

Field Bindweed (*Convolvulus arvensis*)



Identification

- Twining stems (counter -clockwise)
- Elongated arrow -shaped leaves with blunt tips
- Funnel-shaped flowers – 1 inch across
- White to pinkish flowers with long stalks

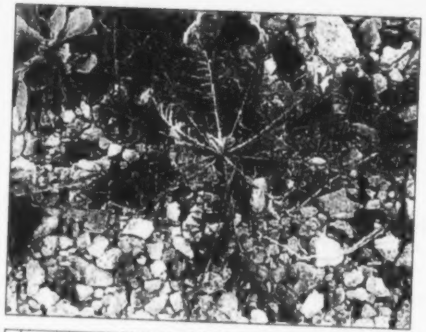
Biology and Ecology

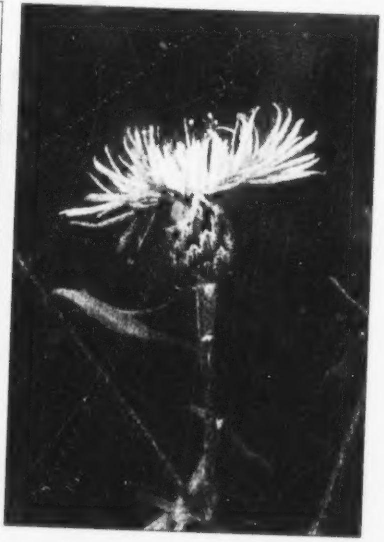
- Deep-rooted perennial weed
- Spreads by seed and root fragments
- Buds on roots can send up shoots
- Seed has germinated after 28 yrs in soil

Location

- Field bindweed is found sporadically throughout the province but in higher numbers south the south Saskatchewan and Qu'Appelle river systems.

Spotted Knapweed (*Centaurea maculosa*)





Identification

- Deeply lobed, "twice -divided" basal leaves
- Purple flowers
- Oval bracts with a black -tipped fringe

Biology and Ecology

- A perennial
- Reproduces from seed and a new shoot each year from a taproot
- Plants may flower only once, or up to three years in succession
- Thirty percent of seeds may be viable after eight years of burial
- Seeds generally fall within a 3 -12 dm radius of the parent plant
- Initial invasion associated with disturbed areas

Location

- Spotted knapweed is reported in Rockglen, Caronport, Chaplin and one site each in the northeast and central sectors of Regina

Wild Parsnip (*Pastinaca sativa*)

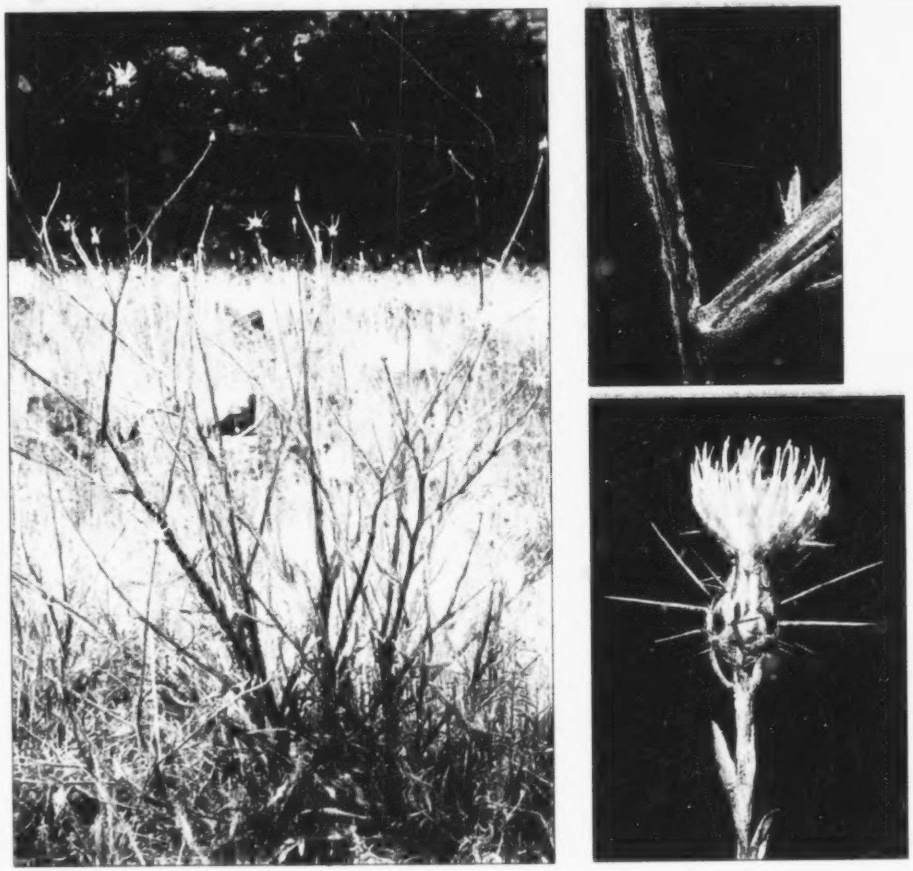
- **Identification**
- Resembles dill plant with yellow flowers
- Divided leaves with mitten shaped leaflets
- Hollow grooved stem
- Stout tap root similar to domestic parsnip

- **Biology and Ecology**
- Skin exposure to sap and sunlight in combination can result in severe burning rashes
- This weed can invade lawns and cause severe contact burns to bare skin. Handle only with gloves!

Location

- Populations are established in the Gruenthal area west of Highway #11, north of Saskatoon and in the Kendal area along highway 48 east of Regina.

Yellow Starthistle (*Centaurea solstitialis*)



- **Identification**
- Bright yellow knapweed-like flower with long spines
- Winged stem

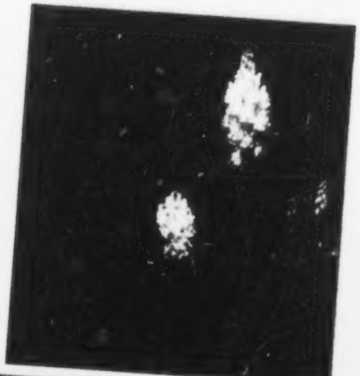
- **Biology and Ecology**
- Winter annual
- Reproduces only by seed

Location

- Established in Montana, Idaho and North Dakota. Alberta has identified and controlled several introductions.

Notify SAFRR if this is found.

Yellow Toadflax (*Linaria vulgaris*)



Identification

- Bright yellow and orange flower that are "snapdragon -like" with a spur below
- Linear leaves that are narrower at each end
- Clear sap

Biology and Ecology

- Found in patches
- Creeping roots

Location

- Yellow toadflax is found in many isolated areas in Saskatchewan.

Noxious Weed Spread

The unprecedented transport of baled hay and straw by truck may also be spreading unwanted noxious weeds. If hay and straw were transported on roads through your municipality than take the 6 steps to early weed detection and control.

- **Step 1** All Municipalities should appoint a Weed Inspector (WI) to enforce *The Noxious Weed Act*
- **Step 2** WI should encourage RM staff (grader and mower operators) to look for noxious weeds
- **Step 3** Control weeds immediately (never allow the introduced weed to seed set)
- **Step 4** WI should track noxious weeds (hay-straw transportation routes to the destination points)
- **Step 5** Municipalities should purchase a GPS navigation receiver to mark noxious weed sites
- **Step 6** WI should try to eradicate small weed patches (only small patches can be eradicated)

Stop the Spread of Leafy Spurge

If you have a weed like leafy spurge, you want it to 'go away'. Most of the time this is not going to happen. Understanding how leafy spurge grows and spreads, along with what you can expect from different control tactics, will give you a control program that works.

A **Weed** may be defined as a plant growing where it is not wanted. This defines Leafy Spurge. Ecologically, Leafy Spurge likes very much where it is growing and is well adapted to the prevailing conditions. Leafy Spurge is so well adapted in the grasslands of the province that it often becomes the dominant plant.

is a reduction in the population of a weed to a level below its existing population. Think of an area which has Leafy Spurge and start your control program by selecting the most appropriate of the three tactics: **Exclusion** (quarantine), **Eradication** or **Containment**.

Use **Exclusion** (quarantine) when the weed entry, growth and spread will cost more than the cost of **exclusion** (quarantine). There will be a cost for keeping Leafy Spurge from spreading to your land.

A few ways of implementing **Exclusion**
- Purchase only weed-free seed
- Do not import hay
- Do not use travelling farm or industrial machinery

Eradication is reducing the existing population of Leafy Spurge to zero. **Eradication** may be practical where a weed has been established for only a few years and/or distribution is limited.

Implementing Eradication
- Use on-going control that kills the weed
- Use on-going surveillance (scouting) to ensure complete control, this year, next year and in future years
- Use a GPS receiver to mark former weed sites so the exact site can be located in the future

Containment is keeping a population within a specific area.

Implementing **Containment**
- Leafy Spurge is always contained within a designated area
- Leafy Spurge can increase (spread) within the 'contained area'
- Acceptance of Leafy Spurge in some areas
- A weed density (low) of Leafy Spurge is maintained or tolerated

Containment is keeping a population within a specific area.

There are **Four Control Methods** for Leafy Spurge

Understanding how effective these methods are against Leafy Spurge will emphasize the need to use the weed control tactics, **Exclusion** (quarantine), **Eradication** or **Containment**) to stop Leafy Spurge from spreading.

Physical – Manual, Mechanical and Burning prevent seed set. Leafy Spurge returns because roots and seeds remain in the soil.

Chemical – Herbicides kill the top growth and none to most of the roots of leafy spurge. Leafy Spurge returns because of seed.

Biological – Insects control Leafy Spurge. There will always be a few biological control insects and Leafy Spurge shoots.

Ecological – Plants do not compete very well with Leafy Spurge. Animals like goats and sheep eat leafy spurge and must always be present when the new top growth from roots or seed appears.

Integrated Weed Control is a combination of 2 or more of the above methods that stress Leafy Spurge and are non-conflicting.

This is when Leafy Spurge is often found

Garry Bowes NWMP

A Single Patch of Leafy Spurge

Control: Use a herbicides to control and prevent Leafy Spurge spread. Mark each site location with a GPS receiver. Repeat the herbicide treatment as needed.

Concerns: Mature seed can catapult up to 15 ft from the patch and move down the road with rotary mowers. During gravel recovery, motor grader blades can drag roots and seed along the road shoulder. Therefore, watch for new weed growth along the roadside and around the patch.

This is when Leafy Spurge should be found

Garry Bowes NWMP

Two Small Patches (A, B) of Leafy Spurge

Eradication of the two patches is worth a try.

Eradication means that you want to reduce this population of Leafy Spurge to zero. **Eradication** may be practical where leafy spurge has been established for only a few years and/or distribution is limited.

Implementing Eradication

- Kill the weed (herbicide) this year, next year and in future years
- Scout every year to ensure complete control
- Mark all weed sites (GPS) for quick and accurate future scouting

Concerns: Patch A is small but dangerous. Motor grader blades can drag roots and seed along the road shoulder.

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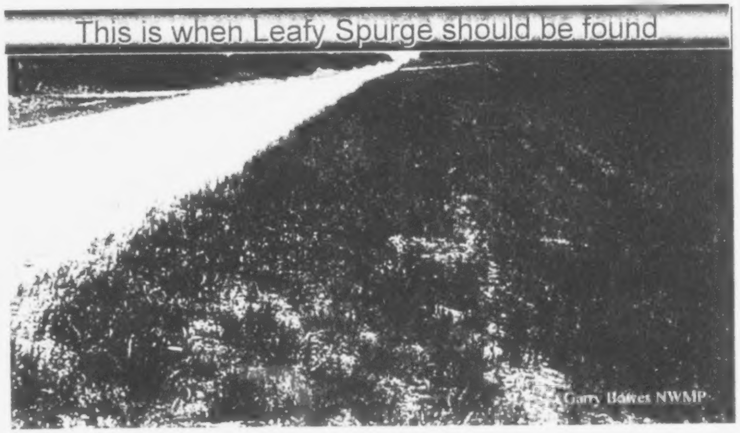

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This amount of Leafy Spurge means on-going control

Multiple Patches of Leafy Spurge

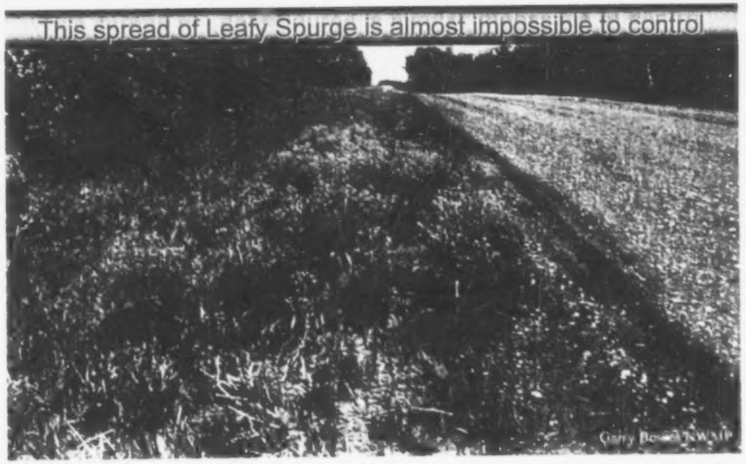
Use the 3 strategies, **Exclusion, Eradication** and **Containment**

Exclusion: Prevent leafy spurge from establishing in the pasture.

Eradication: The opportunity for eradication for the road right-of-way is probably lost because of the expected large amount of seed in the soil.

Containment: Keep (contain) leafy spurge in the right-of-way and not in the pasture. Control (herbicides) Leafy Spurge, as required.

Concerns: Roots and seeds may move along and across the road during gravel recovery and road maintenance. Seed can catapult 15 ft and may enter the pasture. Live seed will remain in soil for years.



This spread of Leafy Spurge is almost impossible to control

Continuous Leafy Spurge

The control strategies, **Exclusion, Eradication** and **Containment**, will not work very well.

Exclusion: The opportunity for **Exclusion** is lost because Leafy Spurge plants (with seed in soil) are found over a large area.

Eradication: The opportunity for **Eradication** is lost because Leafy Spurge is difficult to control in trees and there will be seeds in the soil.

Containment: Leafy spurge can not be contained because it is wide spread in habitats (trees), where control is difficult. Contain outside the area. This site is within a containment area.

Concerns: There is an on-going opportunity for Leafy Spurge spread.

Leafy Spurge control near water is difficult

Mowing can create a good site for Leafy [illegible]

Leafy Spurge Control Near Water is Difficult

Integrated Weed Control is the most effective method or strategy to control leafy spurge. **Integrated Weed Control** is a combination of non-conflicting methods that are known to stress or control leafy spurge. The methods are **Physical** (manual, mechanical, burning), **Chemical** (herbicides), **Biological** (insects) **and Ecological** (plants and animals).

All of the methods have severe limitations when used to control Leafy Spurge that grows next to water.

Physical: Pulling (manual) is impractical. Mowing (mechanical) can be used close to water to prevent seed set but rough land and slope often makes mowing impractical. Also, mowing disturbs shoreline vegetation.

Chemical: Herbicides can not be in surface water and therefore are not used.

Biological: Leafy Spurge Beetles (Insects) eat Leafy Spurge roots, which stresses the weed and eventually reduces its competitive advantage. Leafy Spurge stands are thinned. Plants can be short. Seed production can be less. But Leafy Spurge beetles are not effective close to water.

Ecological: Plants compete poorly with Leafy Spurge. **Animals** such as goats and sheep eat the weed but cattle do not eat the weed.

Integrated Weed Control Solution

Each year, collect and make many Leafy Spurge Beetle (black dot, brown dot and black) releases. As the beetles stress the weed, grasses and other desirable plants become more competitive. Where practical, mowing reduces seed set. Goats and sheep eat and stress leafy spurge. These integrated control methods are non-conflicting.

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Garry Bowes NWMP

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Eradication: The opportunity for eradication for the road right-of-way is probably lost because of the expected large amount of seed in the soil.

Containment: Keep (contain) leafy spurge in the right-of-way and not in the pasture. Control (herbicides) Leafy Spurge, as required.

Concerns: Roots and seeds may move along and across the road during gravel recovery and road maintenance. Seed can catapult 15 ft and may enter the pasture. Live seed will remain in soil for years.

This spread of Leafy Spurge is almost impossible to control

Garry Bowes NWMP

Continuous Leafy Spurge

The control strategies, **Exclusion, Eradication** and **Containment**, will not work very well.

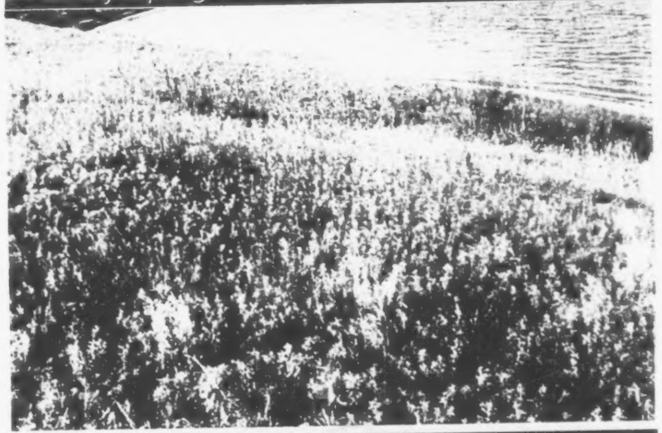
Exclusion: The opportunity for **Exclusion** is lost because Leafy Spurge plants (with seed in soil) are found over a large area.

Eradication: The opportunity for **Eradication** is lost because Leafy Spurge is difficult to control in trees and there will be seeds in the soil.

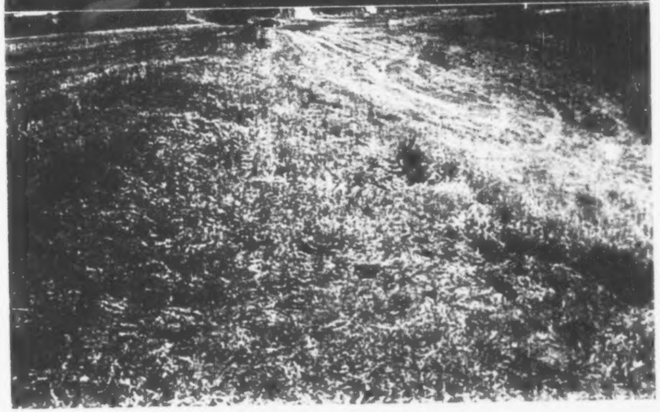
Containment: Leafy spurge can not be contained because it is wide spread in habitats (trees), where control is difficult. Contain outside the area. This site is within a containment area.

Concerns: There is an on-going opportunity for Leafy Spurge spread.

Leafy Spurge control near water is difficult



Mowing can create a good site for Leafy Spurge seed to germinate and establish



Leafy Spurge Control Near Water is Difficult

Integrated Weed Control is the most effective method or strategy to control leafy spurge. **Integrated Weed Control** is a combination of non-conflicting methods that are known to stress or control leafy spurge. The methods are **Physical** (manual, mechanical, burning), **Chemical** (herbicides), **Biological** (insects) **and Ecological** (plants and animals).

All of the methods have severe limitations when used to control Leafy Spurge that grows next to water.

Physical: Pulling (manual) is impractical. Mowing (mechanical) can be used close to water to prevent seed set but rough land and slope often makes mowing impractical. Also, mowing disturbs shoreline vegetation.

Chemical: Herbicides can not be in surface water and therefore are not used.

Biological: Leafy Spurge Beetles (Insects) eat Leafy Spurge roots, which stresses the weed and eventually reduces its competitive advantage. Leafy Spurge stands are thinned. Plants can be short. Seed production can be less. But Leafy Spurge beetles are not effective close to water.

Ecological: Plants compete poorly with Leafy Spurge. **Animals** such as goats and sheep eat the weed but cattle do not eat the weed.

Integrated Weed Control Solution

Each year, collect and make many Leafy Spurge Beetle (black dot, brown dot and black) releases. As the beetles stress the weed, grasses and other desirable plants become more competitive. Where practical, mowing reduces seed set. Goats and sheep eat and stress leafy spurge. These integrated control methods are non-conflicting.

Leafy Spurge Control on a Grassland with Stones Piles

In 1988, black dot leafy spurge beetles were released to the right of the photograph. In the area circled by the yellow line, Leafy Spurge has been thinned out, presumably by the beetles. Leafy Spurge flourished in the area circled by the red line which is a pile of rocks. Females lay eggs the plant-ground surface. A critical stage in the beetle life cycle occurs when the eggs hatch and larvae emerge. To survive, larvae must find young, tender Leafy Spurge roots growing within 2 to 3 inches of the top soil. In the rock pile, the distance that the larvae must travel is long. Leafy Spurge flourished.

The area within the red circle was treated with a herbicide a few weeks before the photograph was taken. The rock pile will need to be retreated with a herbicide, as required, in the future.

This is integrated control using a herbicide and biological control agents

Leafy Spurge Control with Beetles

During the late 1980's and early 1990's leafy spurge beetles were released in a number of locations in a valley west of Last Mountain House Provincial Park.

In 2001, monitoring with a sweep net found 2 leafy spurge beetles and several Leafy Spurge plants, 2 to 3 inches tall. In 2002, no leafy spurge beetles or Leafy Spurge plants were found.

At other release sites in the valley, leafy spurge beetles have not controlled the weed. Often, poor control occurs when Leafy Spurge grows with woody vegetation.

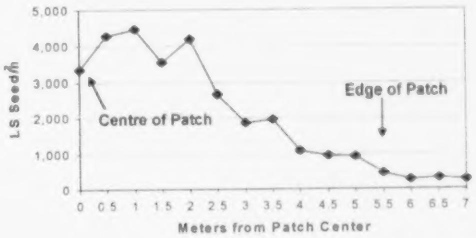
Why Leafy Spurge Control is Difficult

- Patches, green yellow bracts,
- Latex, deep roots

- Dominates pastures
- Cattle refuse to eat

- Lateral root spread
- Seed: Catapult 15 ft
- Annual rate of loss for seed: 13%

Figure 1 Leafy Spurge Seed Rain



Leafy Spurge Control is Difficult Because of Roots and Seed

This is how seed helps Leafy Spurge survive.

Seed Rain is the amount of produced seed that falls on to the soil surface. Each year, Seed Rain ranges from 3,000 to 4,500 seeds/m^2 near the centre of a patch to 450 seeds/m^2 near the edge of the patch (Figure 1).

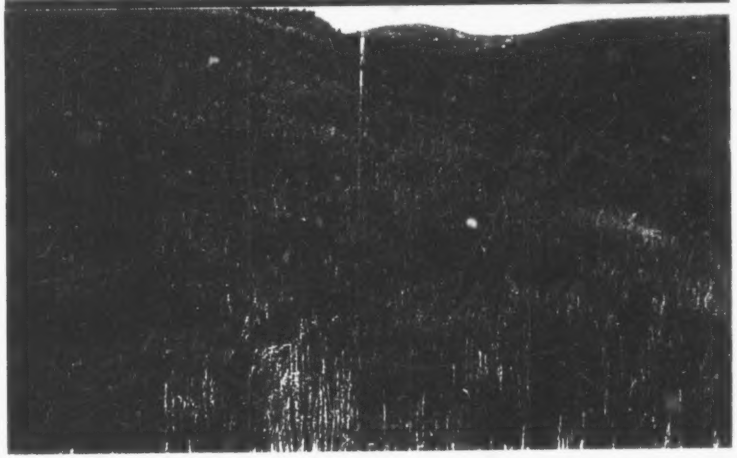
Seed can catapult 15 ft from the patch edge. Notice the amount of seed beyond the patch edge in Figure 1.

The annual lost of seed from the soil is about 13%/yr. The maximum Seed Rain in Figure 1 was about 4,500 seeds/m^2. If you started a control program that stopped seed production, then one year later there would be 3,915 seeds/m^2 in the soil. After 10 years, with no seed production there would 970 seeds/m^2 in the soil. This is the minimum because seed may have dropped many years before control was started.

If the patch was not control for ten years and 4,500 seeds/m^2 were produced every year, then there would be 23,600 seeds/m^2 in the soil.

Leafy Spurge Control on a Grassland with Stones

Leafy Spurge Control with Beetles



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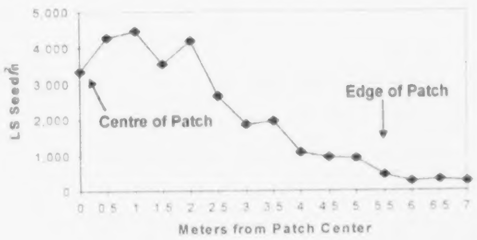

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Leafy Spurge Beetle Life Cycle

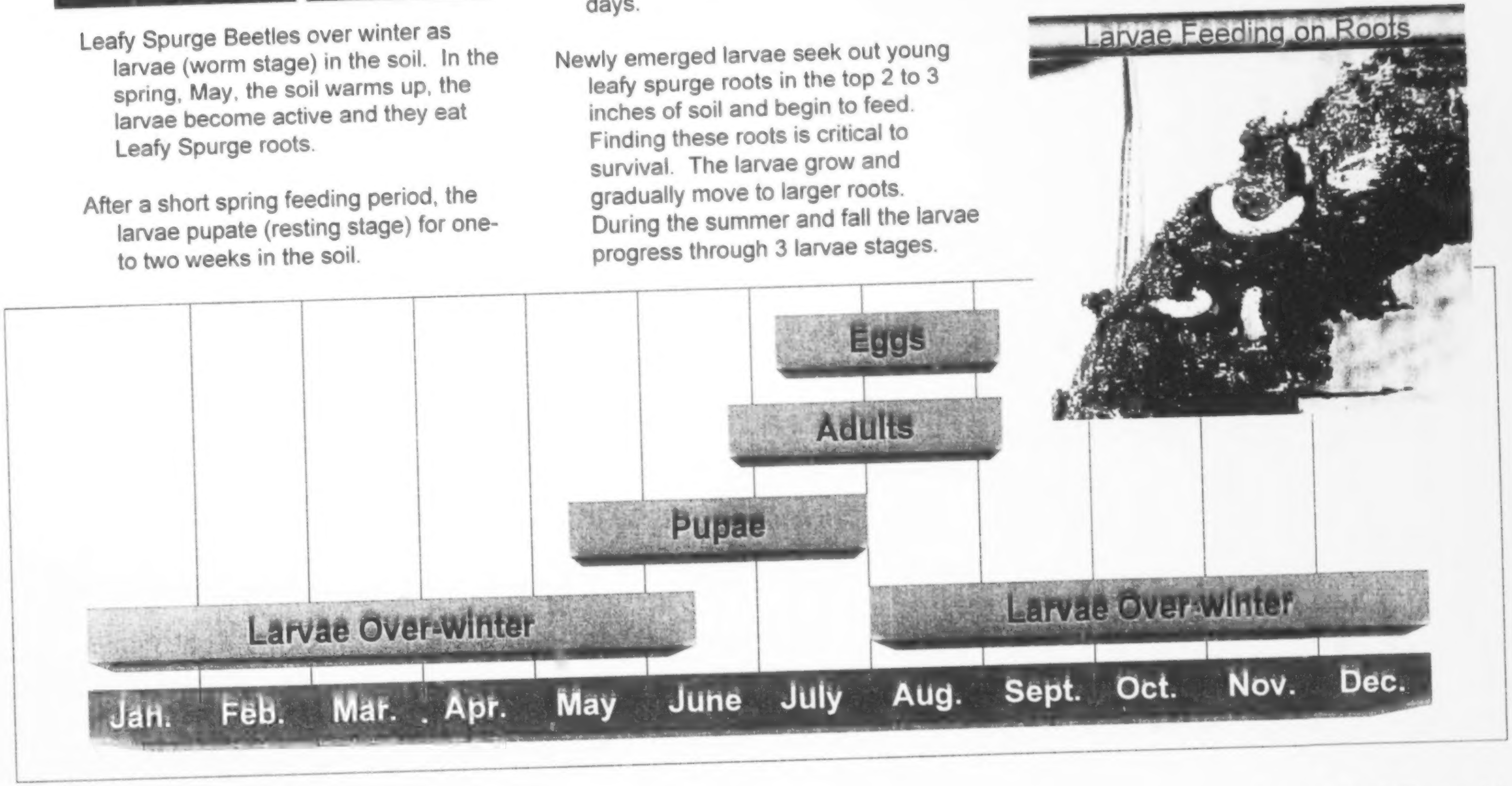
Leafy Spurge Beetles over winter as larvae (worm stage) in the soil. In the spring, May, the soil warms up, the larvae become active and they eat Leafy Spurge roots.

After a short spring feeding period, the larvae pupate (resting stage) for one- to two weeks in the soil.

Around the first of July, adult emerge from the soil and the females lay eggs near the base of the leafy spurge stems. Females lay between 50 – 500 eggs which hatch in 14 – 10 days.

Newly emerged larvae seek out young leafy spurge roots in the top 2 to 3 inches of soil and begin to feed. Finding these roots is critical to survival. The larvae grow and gradually move to larger roots. During the summer and fall the larvae progress through 3 larvae stages.

In the fall the larvae have reached their third stage, the temperature is cool, and they move deeper into the soil, where they over winter.



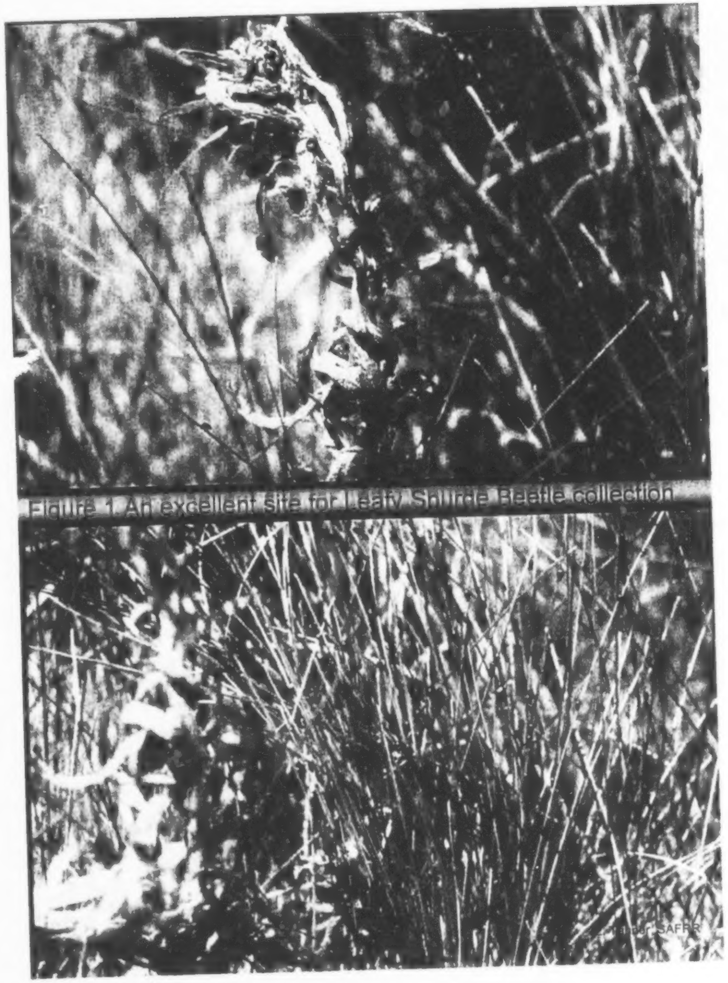


Figure 1 An excellent site for Leafy Spurge Beetle collection

Collecting and Releasing Leafy Spurge Beetles

Plan to Collect and Release Leafy Spurge Beetles

April: Call a meeting for those who are interested in the Biological Control of Leafy Spurge and decide:

- Who wants to collect and release Leafy Spurge Beetles
- Who will monitor past release sites for beetle activity
- Who will phone those interested in collecting beetles

Everyone planning to collect beetles should have a sweep net, collection tubes, large plastic bags, heavy duty paper bags, tape, cooler and blue ice (frozen) before collection day. Collection tubes with 1/8 to 3/16 inch holes, on centre, should be constructed before collection day.

May: When growth starts, look for and mark new beetle release sites. Plan for the number and place where beetles will be released.

June: Starting in mid to late June, monitored past beetle release sites that are for suitable collection.

July: Beetles should be collected as soon a suitable number is available in the field (Figure 1). This will often occurs during the first two weeks of July, on a hot sunny day with light winds. Use 'phoning trees' to quickly alert everyone interested in collection.

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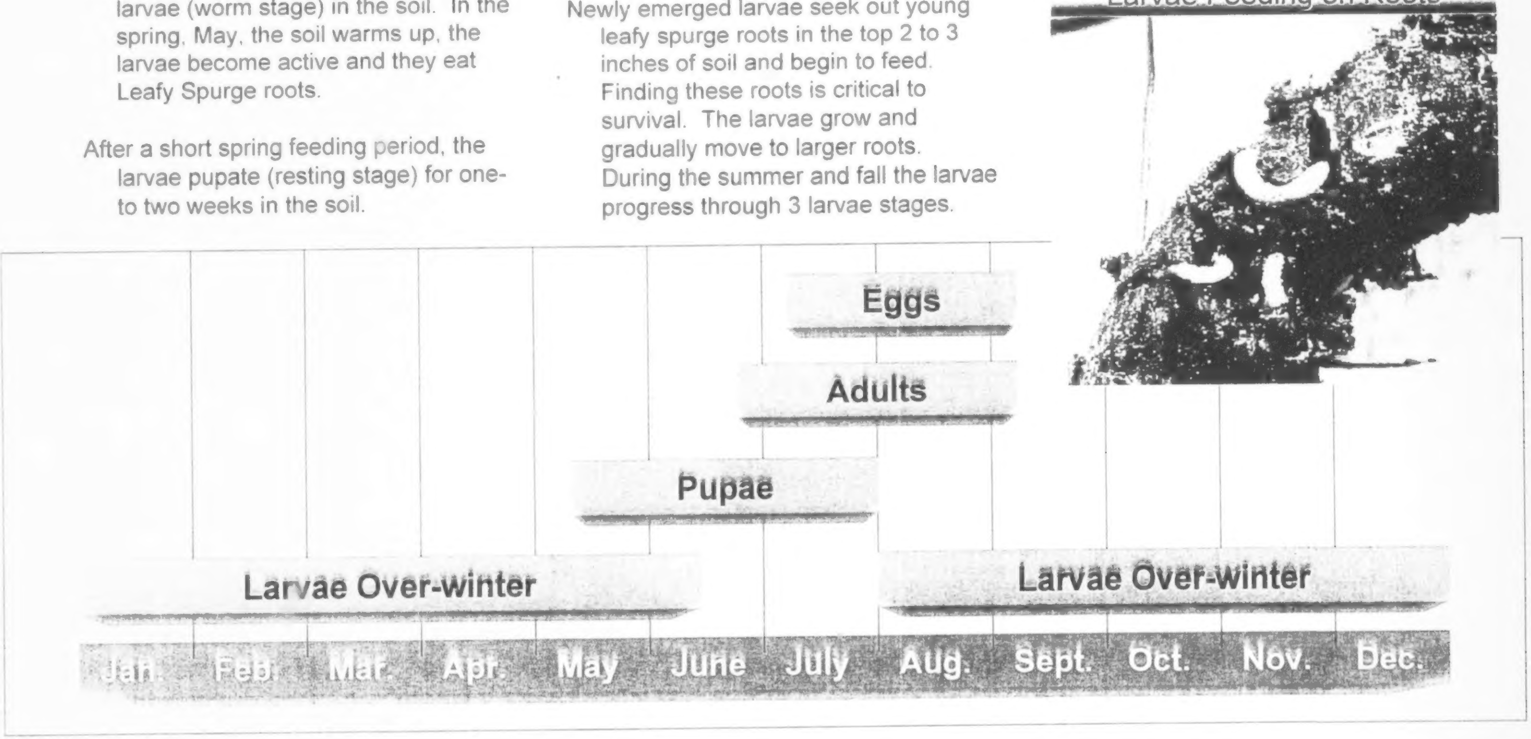
Larvae Feeding on Roots



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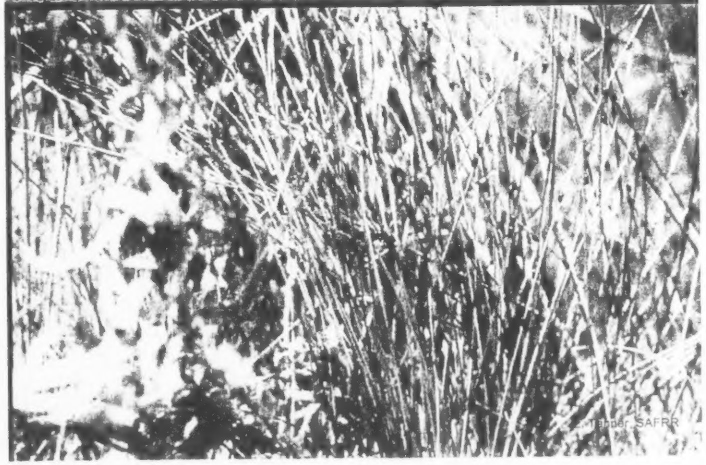

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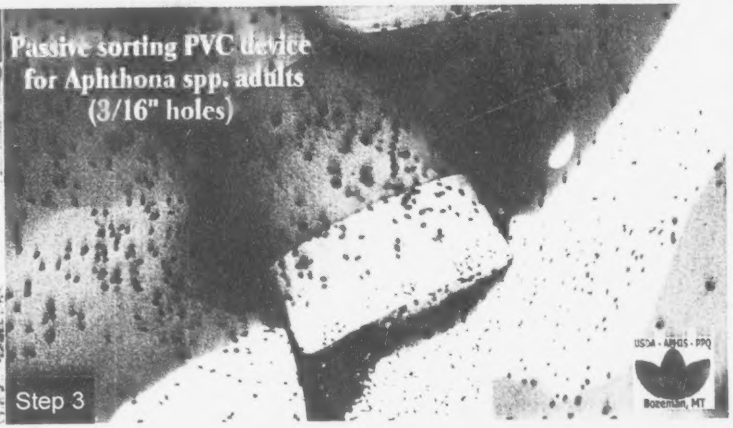
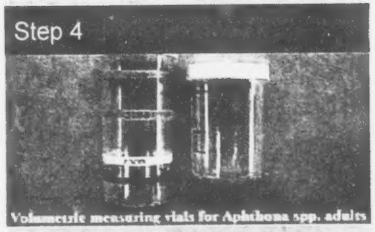
Leafy Spurge Beetle Collection and Transport


Passive sorting PVC device for Aphthona spp. adults (3/16" holes)
Step 3
USDA - APHIS - PPQ
Bozeman, MT

- Step 1 Collect Leafy Spurge Beetles with a sweep net. Collect as early as possible (July) when there are adults are plentiful.
- Step 2 Keep beetles and remove trash from the net.
- Step 3 Put the contents (mostly beetles) from the sweep net into a PVC collector. Place the collector into a clear plastic bag. In a few minutes the beetles will crawl through the 3/16 in opening.
- Step 4 Using a small plastic container with a known volume (calibrate with water) to estimate the number of beetles collected.
- Step 5 Put the beetles (2000 to 5000) into a paper bag with a small amount of Leafy Spurge and tape.
- Step 6 Place the paper bag with the beetles into a cooler for transport. Move the beetles as soon as possible to a new site. Keep the cooler cold with blue ice.



10 ml = 1,000 adults

The Distribution of Biological Control Agents for Scentless Chamomile in Saskatchewan

G.G. Bowes[1], A.S. McClay[2], C.A. Brenzil[3]

[1]Coordinator, Noxious Weed Control Program, Saskatoon, SK, S7K 2H6
[2]Scientist, Alberta Research Council, Vegreville, AB, T9C 1T4
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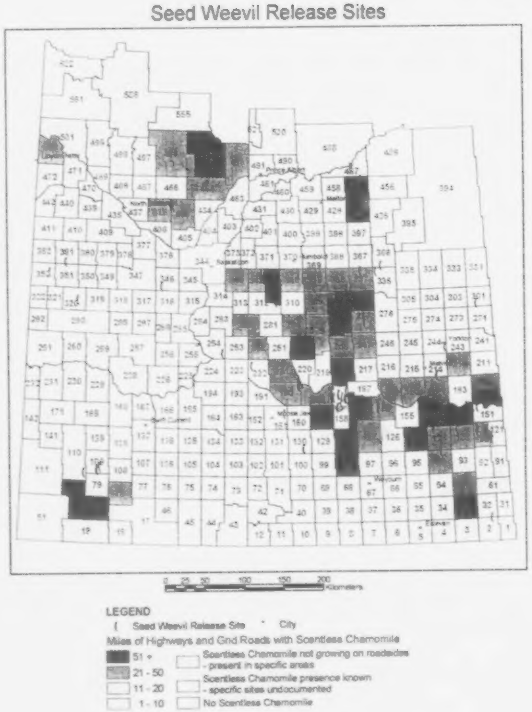
Seed Weevil Release Sites
0 25 50 100 150 200 Kilometers
LEGEND
Seed Weevil Release Site
City
Miles of Highways and Grid Roads with Scentless Chamomile
51 +
21 - 50
11 - 20
1 - 10
Scentless Chamomile not growing on roadsides - present in specific areas
Scentless Chamomile presence known - specific sites undocumented
No Scentless Chamomile

Figure 1. Distribution of seed weevil release sites in Saskatchewan

Abstract

In April 1999, a project was started to develop integrated control programs for noxious weeds that emphasize the role of biological control agents. The focus was on a seed weevil, which was released in 1993, and the 1999 release of a gall midge for scentless chamomile. Both agents have been released at numerous locations in many municipalities where scentless chamomile is found. Data on the spread of the agents from a release point was used to estimate the potential distribution of the seed weevil and gall midge. Many rural municipalities have scentless chamomile but the biological control agents may not have spread to the weed. New agent releases should be made in rural municipalities which have had no prior releases.

Introduction

Integrated weed control is the combination of non-conflicting control methods and/or strategies. When a biological control agent is licensed for release in Canada, the usefulness and role of the agent in an integrated control program is unknown. In Saskatchewan, a seed weevil and gall midge were

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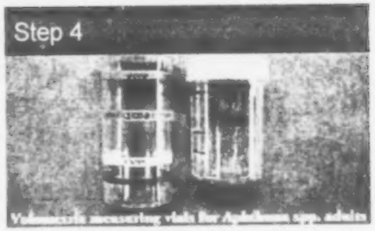

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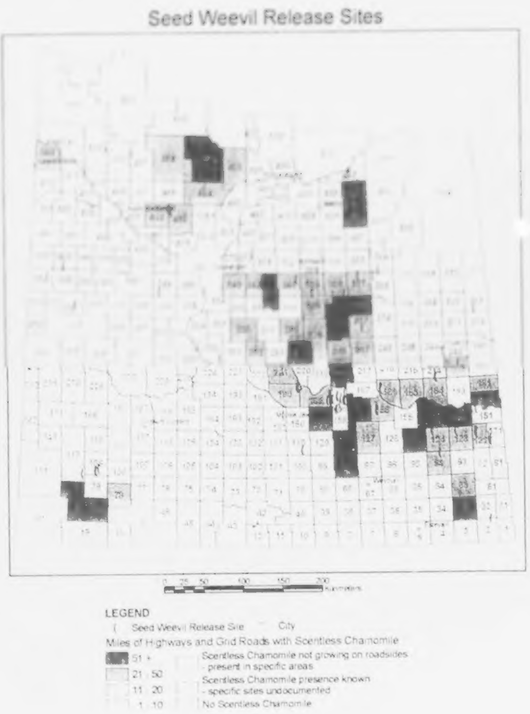
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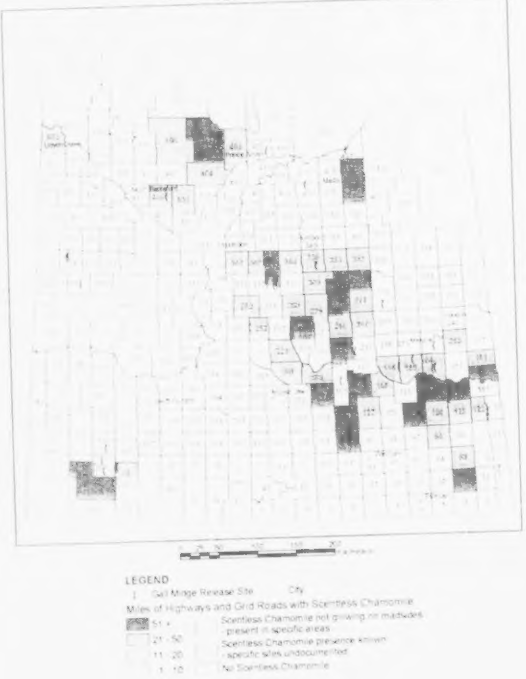
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Figure 2. Distribution of gall midge release sites in Saskatchewan

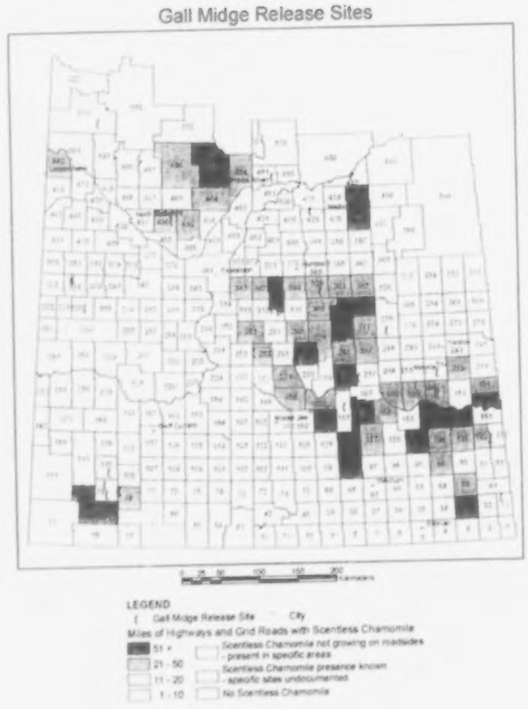
released initially in 1993 and 1999, respectively, for the control of scentless chamomile. This report documents the release, distribution and spread of the two agents in the province. To achieve their full potential, the agents must be uniformly present on scentless chamomile in the province.

Methods

In Saskatchewan, landowners and occupiers of Land are encouraged to ask their local Extension Agrologist for biological control agents. The names of those requesting agents are maintained on a list and requests are filled when the agents are available. **The demand for agents has always exceeded supply.**

During 1995 and 1996, seed weevils were collected in Nova Scotia and released in the province. During 1999 to 2001, seed weevils were collected in the fall and over wintered at the Alberta Research Council (ARC) laboratory in Vegreville, AB. The following June, the agents were released. In the fall of 2000, seed weevils were collected and over wintered in the Crop Protection Laboratory at Regina. In June, the agents were released. In Saskatchewan, there are 108 documented seed weevil release sites.

Gall midges are distributed throughout the province by transplanting scentless chamomile plants with visible galls. Between 1999 and 2001, suitable transplants were obtained from Vegreville and distributed throughout the province. During the fall of 2002, scentless chamomile plants in the rosette stage showing visible galls were dug out of the ground, distributed and transplanted. In the province, there are 41 documented release sites for gall midges.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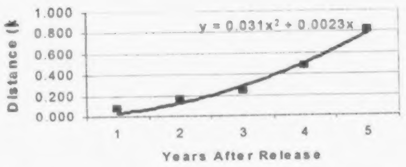


Figure 3. Trendline for seed weevil spread for years 1 to 5

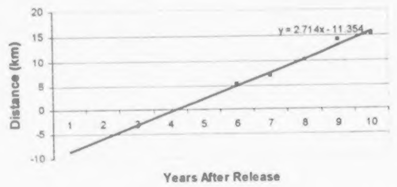


Figure 4. Trendline for seed weevil spread for years 6 to 10

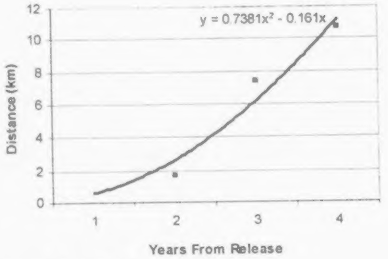


Figure 5. Trendline for gall midge spread

When biological control agents are released, landowners, land occupiers, Weed Inspectors and Extension Agrologists are asked to complete a release form and return it to the Noxious Weed Coordinator. The release form identifies the release date, release location, environmental condition at release time and a description of the vegetation. Since 2000, the release form has contained a request for the latitude and longitude of a release site, which is recorded by a Global Position System (GPS) navigation receiver.

Each year some of the release sites are visited and the establishment of the biological control agent is monitored. This information is updated yearly and maintained in an electronic report, which is called, Scentless Chamomile Biocontrol Agent Information Guide. When a site is monitored, the position of the site is either checked or recorded with a GPS navigation receiver. Each spring the Guide is e-mailed to all Extension Agrologists in Saskatchewan.

The latitude and longitude readings recorded (GPS) for release sites were used to map the distribution of agents in the province. For sites that were not monitored, the latitude and longitude was calculated from legal land locations.

The location of each site was plotted on a map of Saskatchewan which showed the distribution of scentless chamomile along road rights-of-ways by rural municipality.

Scentless chamomile that grows along road rights-of-ways was mapped between 1999 and 2001. The spread of the agents across the province up to 2002 was estimated from data collected by Dr. McClay in Alberta. Each year the farthest distance that a seed weevil or gall midge was found from a release point was recorded by Dr. McClay. Regression equations were used to represent the data (Figures 3 to 5). The circles on the maps is a "best-case" scenario for the spread of the biological control agents in one direction, based on the time elapsed since release at a site. Agent spread does not mean that an agent is present in all parts of the circle.

Results and Discussion

Ten years after release in Alberta, the seed weevil had spread about 15 km from the release point (Figures 3 and 4). The spread of the seed weevil from the release point during the first five years was slow when compared to the spread of the agent after the fifth year. The reason for difference in the spread of the seed weevil before and after the fifth year is unknown.

On the fourth year after a gall midge release, the biological control agent had spread 10 km (Figure 5).

Seed weevil and gall midge release sites are distributed across Saskatchewan in association with the occurrence of scentless chamomile (Figures 1 and 2).

The gall midge is spreading over the Saskatchewan landscape more quickly than the seed weevil.

Release sites tend to be grouped in to a few Rural Municipalities. To ensure that the seed weevil and gall midge spread across the province, Extension Agrologists and Weed Inspectors should try to have one release site of each agent in a rural municipality that has scentless chamomile. Then Extension Agrologists and Weed Inspectors should put additional release sites in those rural municipalities that have the weed occupying many miles of road rights-of-ways.

Conclusions

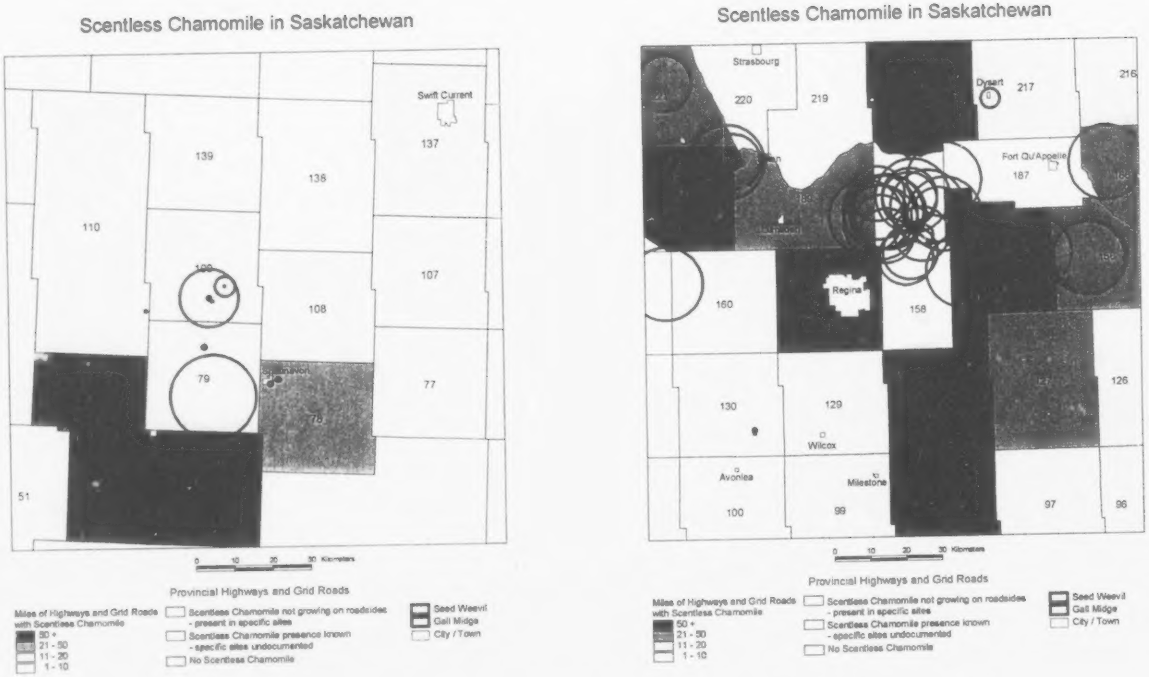
The seed weevil spread slower during the first five years after release than during the next five years.

After release, the seed weevil can spread up to 15 km in 10 years.

After release, the gall midge can spread up to 10 km in 4 years.

The spread of the gall midge is faster than the spread of the seed weevil.

To ensure that the seed weevil and gall midge spread across the province, Extension Agrologists or Weed Inspectors should try to have one release site of each agent in a rural municipality that has scentless chamomile.


Scentless Chamomile in Saskatchewan

Scentless Chamomile in Saskatchewan

Figure 6. The distribution of the seed weevil and gall midge in the rural municipalities near Shaunavon and Regina, Saskatchewan

Acknowledgements

Maps were prepared by Geomatics Unit, SAFRR, Regina, Saskatchewan. The Noxious Weed Management Program is funded by the Technology Adoption and Demonstration (TAD) Fund.

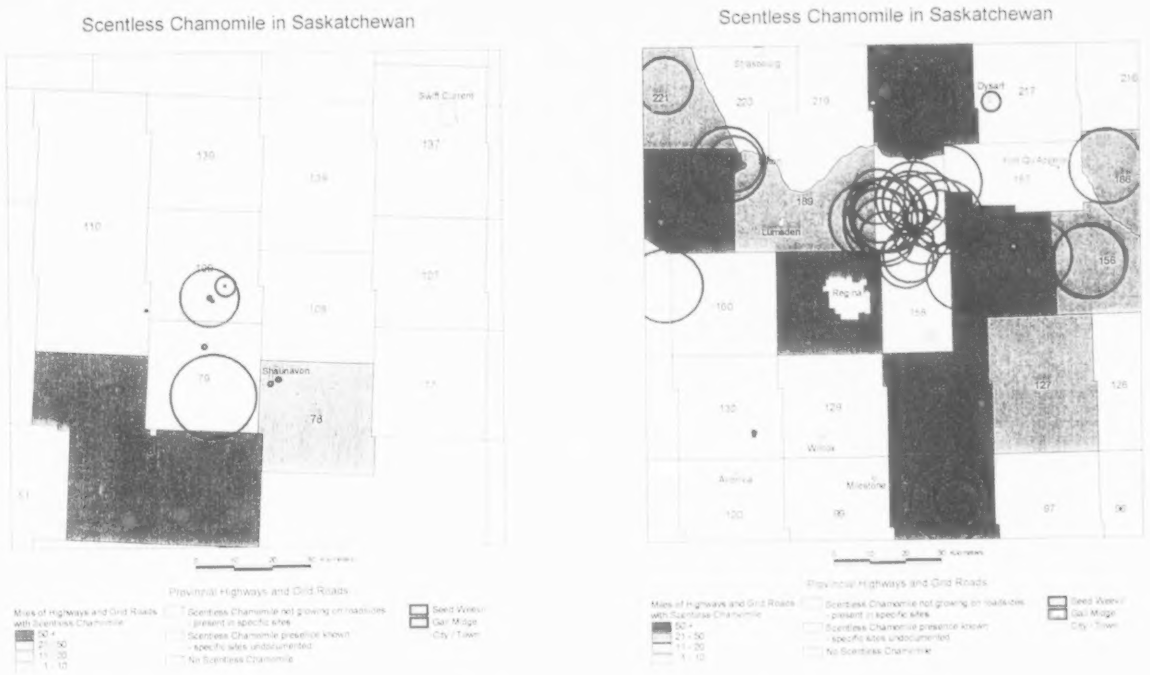

Scentless Chamomile in Saskatchewan
Swift Current
Shaunavon
110
139
138
137
107
108
79
78
77
51
Scentless Chamomile in Saskatchewan
Strasbourg
Dysart
Fort Qu'Appelle
Lumsden
Regina
Wilcox
Milestone
Avonlea
221
220
219
218
217
216
189
187
186
160
159
158
157
156
130
129
128
127
126
120
99
97
96
0 10 20 30 Kilometers
Provincial Highways and Grid Roads
Miles of Highways and Grid Roads with Scentless Chamomile
50 +
21 - 50
11 - 20
1 - 10
Scentless Chamomile not growing on roadsides - present in specific sites
Scentless Chamomile presence known - specific sites undocumented
No Scentless Chamomile
Seed Weevil
Gall Midge
City / Town

Figure 6 The distribution of the seed weevil and gall midge in the rural municipalities near Shaunavon and Regina, Saskatchewan

Acknowledgements

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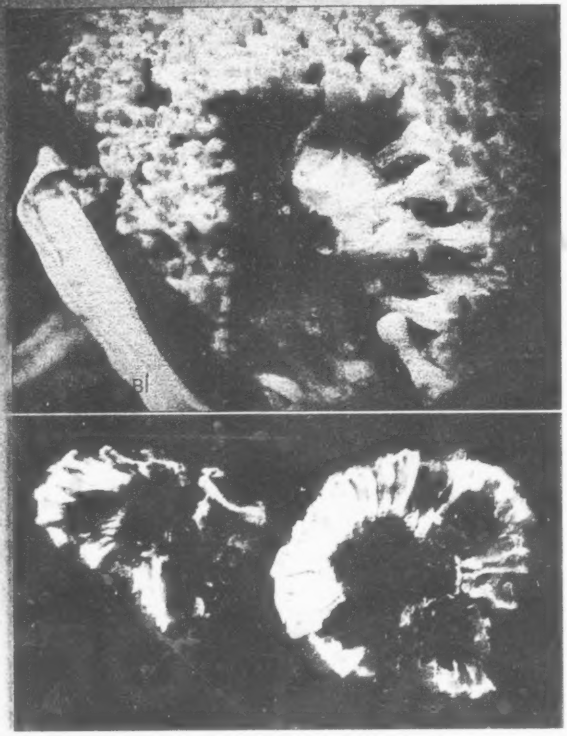
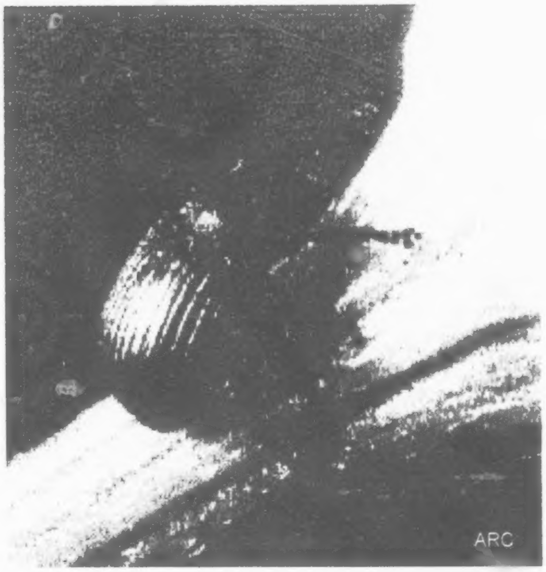


Scentless Chamomile Seed Weevil

- ✓ Adult emerging from a seed head
- ✓ Several cavities with weevils in a seed head

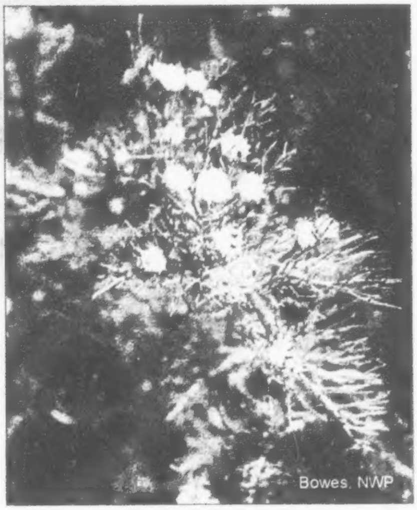


Scentless Chamomile Seed Weevil

- ✓ Seed weevils are approximately 2 mm long and are shiny black

How and When Do I Collect Scentless Chamomile Seed Weevils?

- Contact Extension Agrologist for weevil release locations


Bowes, NWP

Spring Collection

- ✓ Pick weevils off flower buds when the white petal first appears
- ✓ Collect 100 weevils and transport to a new site

Late Summer Early Fall Collection

- In late summer, seed heads, containing weevils can be collected and transported to a new location

Bowes, NWP

- ✓ Break open seed heads to estimate the number of weevils in a head
- ✓ Collect 200 weevils per release

How Well are Seed Weevils Establishing on Scentless Chamomile?

- Seed weevils reduce seed set on scentless chamomile
- One larva eats 11 seeds
- Of the 1995 and 1996 releases, 11 sites (called problem sites) were thought to have failed because of flooding or site destruction
- In 2003, weevils were found at 9 of the 11 problem sites, whereas on the frequently monitored sites, weevils were found on 16 of the 18 sites
- On 3 sites neither weevils or scentless chamomile were found
- As long as a few scentless chamomile plants are present, weevils are usually found

Problem Sites (1995 and 1996 releases):	11
Weevils found after 30 min search:	9
Weevils not found after 30 min search:	2
Regular Monitored Sites:	18
Weevils found after 30 min search:	16
Weevils not found after 30 min search:	2

Scentless Chamomile Gall Midge Eggs

- ✓ Females lay tiny red eggs on the growing points of plants
- ✓ The eggs in the photo of a seedling at the 4-leaf stage are just visible to the human eye

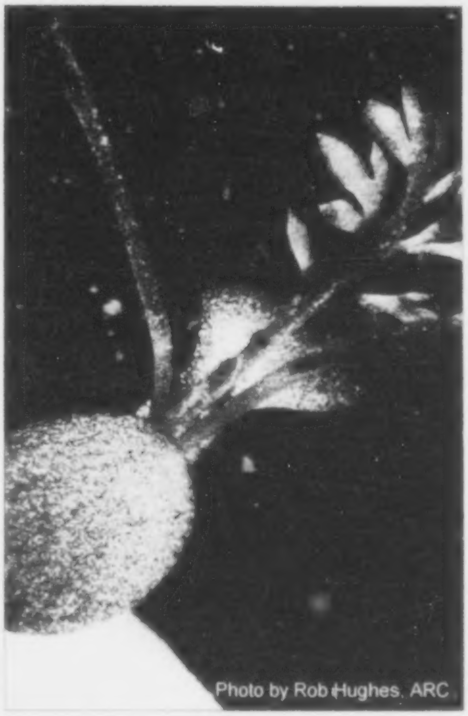
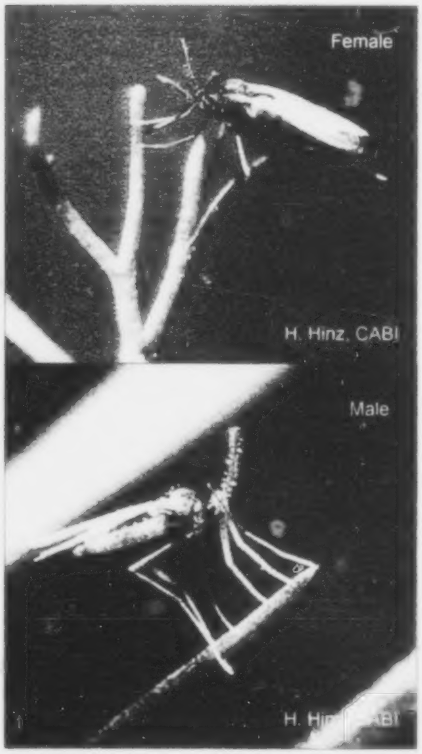


Photo by Rob Hughes, ARC



H. Hinz, CABI

H. Hi CABI

Scentless Chamomile Gall Midges

- ✓ Adult gall midges are tiny, delicate flies
- ✓ The females live 4 times longer than the males, which live up to 12 hr at 15°C
- ✓ Adults are rarely observed on scentless chamomile plants

How and When Do I Collect Scentless Chamomile Gall Midges?

- Contact Extension Agrologist for weevil release locations

  - ✓ Gall midges induce galls in the growing tips of rosettes, bolting plants, leaf axils, buds and flowers
  - ✓ A gall is visible as a mass of short crowded leaf-like growths, with a "mossy" appearance

- The best time to collect gall midges in the late fall after a killing frost

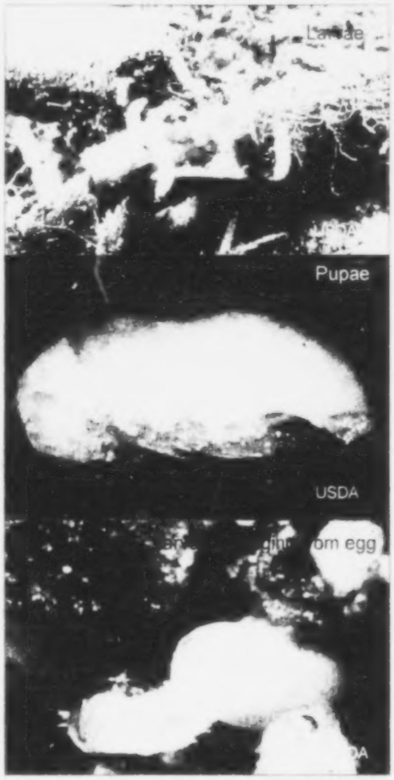
  - ✓ Dig up the chamomile plants with galls and transplant them at a new location
  - ✓ Water as required

How Well are Gall Midges Establishing on Scentless Chamomile?

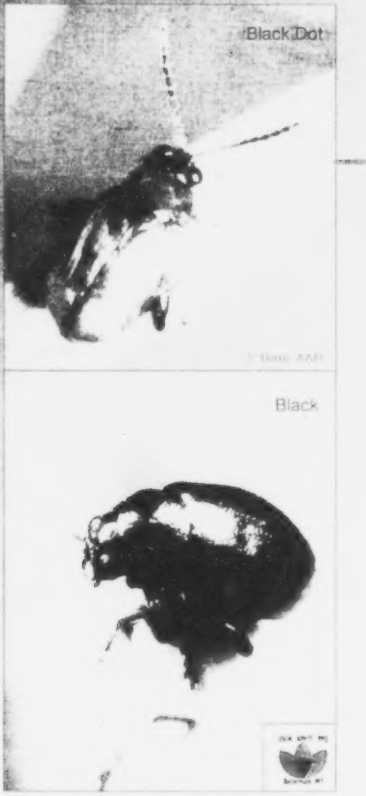
- Gall midges released on scentless chamomile reduce plant vigour
- Galls found on 12 of 22 release sites
- The main reasons that galls were not found on 10 sites was because:
    1. Grasshopper attack (4 sites)
    2. Sites were monitored at the wrong time (2 sites)
    3. Site cultivated (1 site)
    4. Gall Midges did not establish (3 sites)

Year Gall Midges Released	Galls Found on Scentless Chamomile	Galls not Found on Scentless Chamomile	Possible Reasons for Gall Midges not Establishing
1999	4	1	1 Site cultivated
2000	1	3	3 Sites, Scentless Chamomile consumed by grasshoppers
2001	2	3	1 Sites, Scentless Chamomile consumed by grasshoppers
2002	4	2	1 Site monitored too early in spring
2003	1	1	1 Site monitored too early in spring
Total	12	10	

The Life Cycle of Leafy Spurge Beetles



- ✓ Beetles over winter as larvae
- ✓ In spring the larvae pupate, from which adults emerge in July
- ✓ Adults lay eggs, which hatch and larvae emerge in August
- ✓ Continually monitor leafy spurge beetle release sites to find the best time to collect



Leafy Spurge Beetle Identification

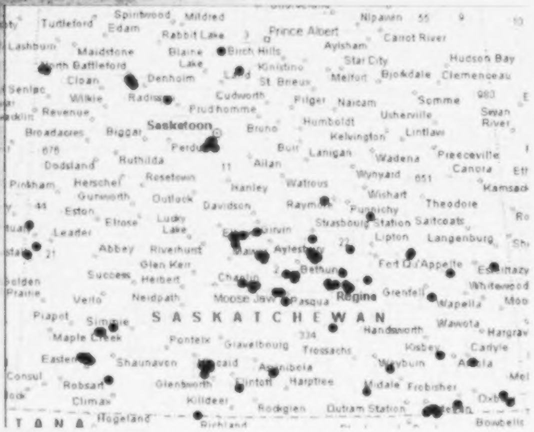
- ✓ Black dot beetles are 2-3 mm long, oval shaped and are bronze with a black dot behind the head
- ✓ Black beetles are 3 mm in length and are all black
- ✓ The life cycles of the two beetles are similar

When Do I Collect Leafy Spurge Beetles?

- Collect adult beetles when they first appear on foliage of leafy spurge
- Beetles appear around the first of July near Estevan and mid-July around North Battleford

- The beetles lay eggs as soon as they emerge from the soil

Leafy Spurge Release Sites



- Contact an Extension Agrologist for the locations of release sites

- A sweep net is needed to collect beetles

- Use a collector tube to prevent noxious weed spread

How Effective are Beetles for the Control of Leafy Spurge?

Ground Cover Of Leafy Spurge On Beetle Release Sites

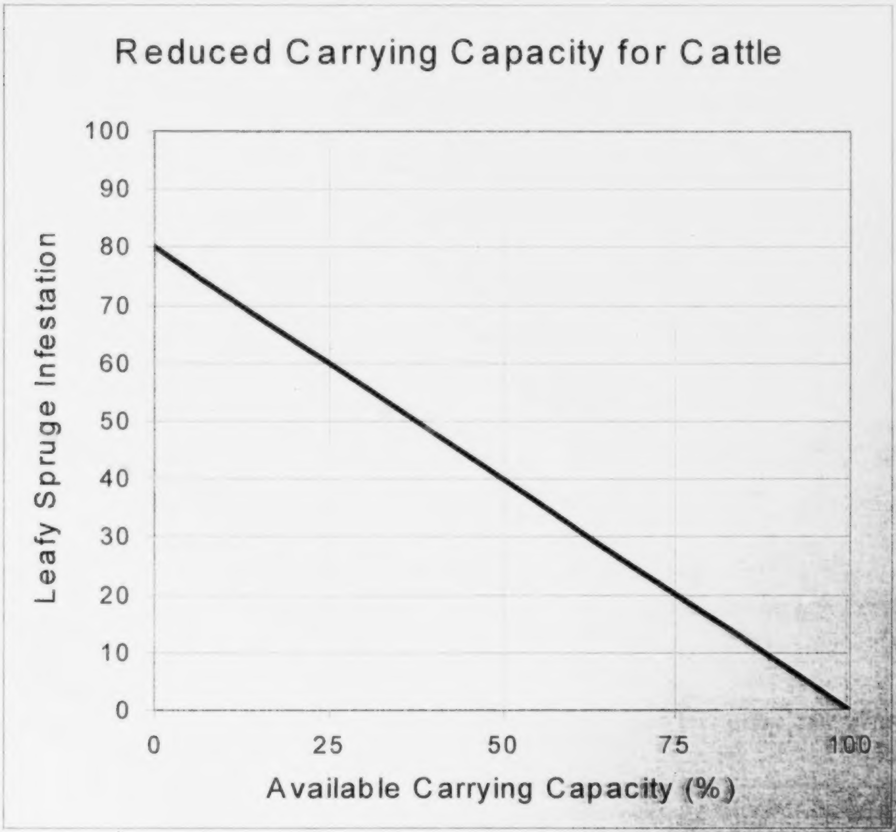
- ✓ At 5% of the release sites, leafy spurge cover was 0
- ✓ At 34% of the release sites, leafy spurge cover was = 15% and grazing loss was = 19%

Years After Release	Leafy Spurge Cover (%)	% Grazing Loss	Number of Beetles/ Sweep	Percent of Samples
2 - 16	0	0	1	5%
2 - 16	1 - 10	1 - 13	4	17%
2 - 16	15	19	10	12%
2 - 16	20	25	8	10%
2 - 16	21 - 40	26 - 50	7	26%
2 - 16	41 - 100	51 - 100	5	31%

- ✓ The cover of the ground by leafy spurge was estimated on 120 leafy spurge release sites
- ✓ Black dot and black beetles were released for the biological control of leafy spurge
- ✓ Beetles were release between 2 and 16 years ago

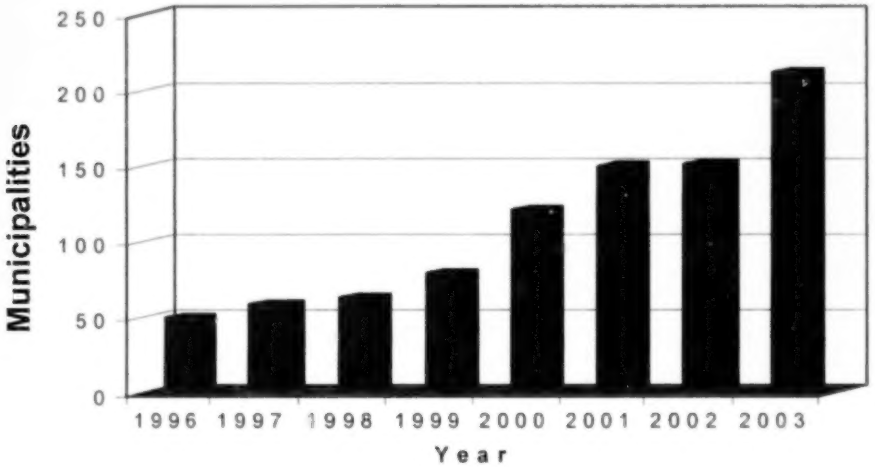
Loss of Grazing from Leafy Spurge

- Cattle do not graze leafy spurge
- 20% ground cover of leafy spurge reduces the carrying capacity by 25%
- 40% ground cover of leafy spurge reduces the carrying capacity by 50%



Weed Inspector Report

- **Enforces the Noxious Weed Act**
- **Prevents Weed Spread**
- **A good contact for information on the location of weed**



- **In 2003, 202 Rural Municipalities and 10 Urban Municipalities appointed Weed Inspectors**
- **Saskatchewan has 367 Weed Inspectors**

Plants that grows on many isolated sites in Saskatchewan

Common Tansy
Field Bindweed
Leafy Spurge
Yellow Toadflax

Field Bindweed, Leafy Spurge and Yellow Toadflax are noxious weeds.

Read and retain how to recognize these weeds. While these weeds are found in isolated areas, an area could be close enough to your municipality that agricultural and industrial activities may unintentionally introduce one of these weeds.

Plants that grows on many isolated sites in Saskatchewan

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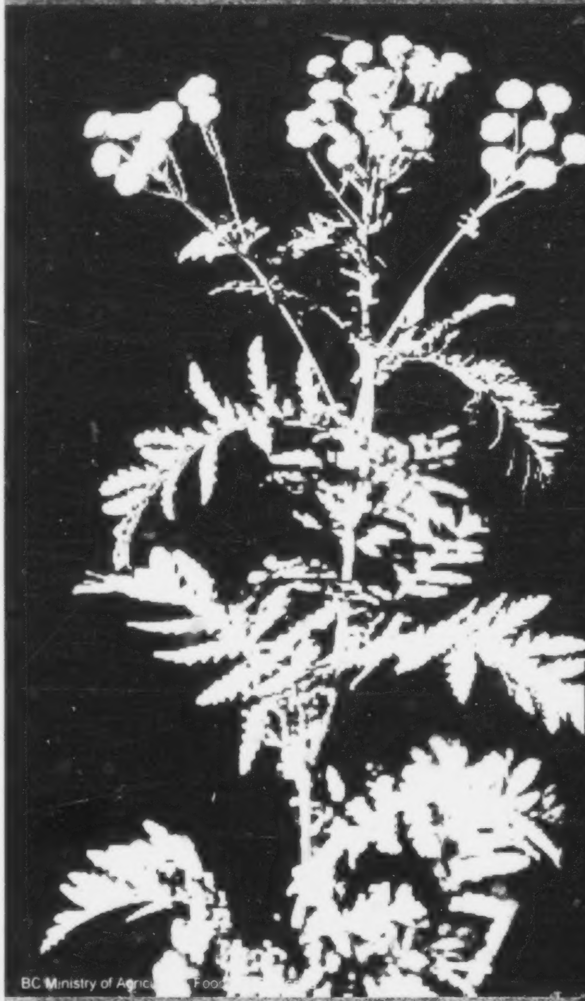
Common Tansy (*Tanacetum vulgare*)

Grows on many isolated sites in Saskatchewan

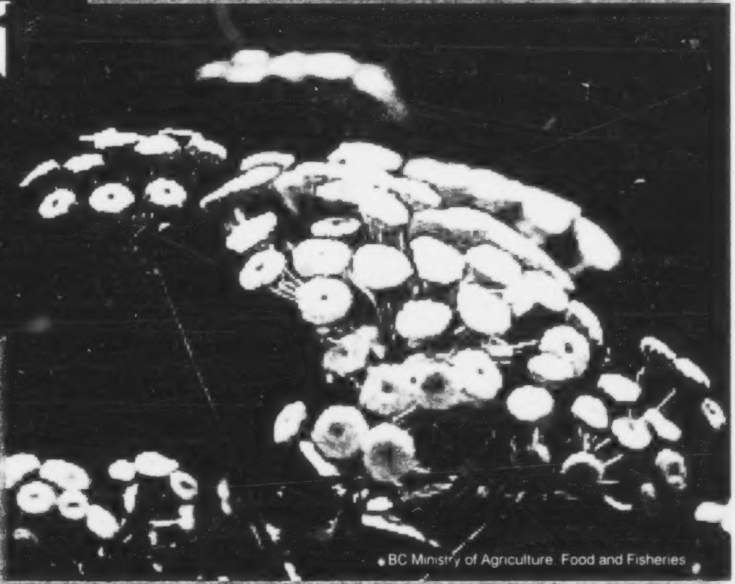


BC Ministry of Agric Food

Identification

Leaves are fern-like, dark green and are aromatic when crushed

Flowers are yellow in a flat-top cluster



© BC Ministry of Agriculture, Food and Fisheries

Biology and Ecology

Perennial herb

Poisonous but unpalatable to livestock

Invades disturbed sites

Found along roadsides, fence lines, stream banks and waste areas

If you find this weed report the location to a municipal office or a Weed Inspector

Location

North east Saskatchewan and in isolated areas throughout the province

CARDS Canadian Adaptation and Rural Development Saskatchewan

Agriculture, Food and Rura Revitalization

2004

Wanted Dead to Prevent Spread

Yellow Toadflax

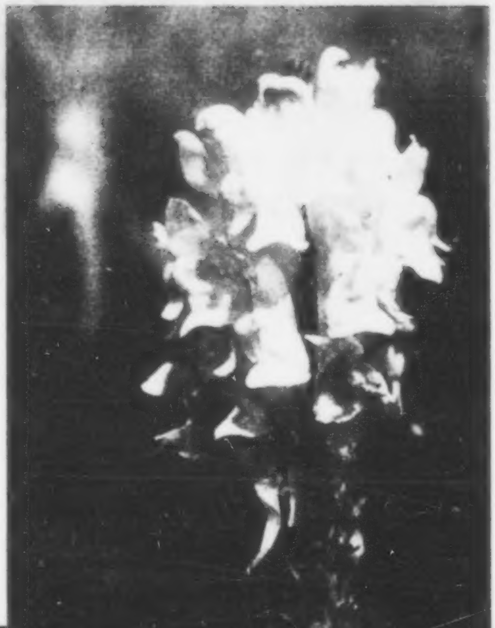
Displaces vegetation in pastures and native habitats

Cattle do not graze

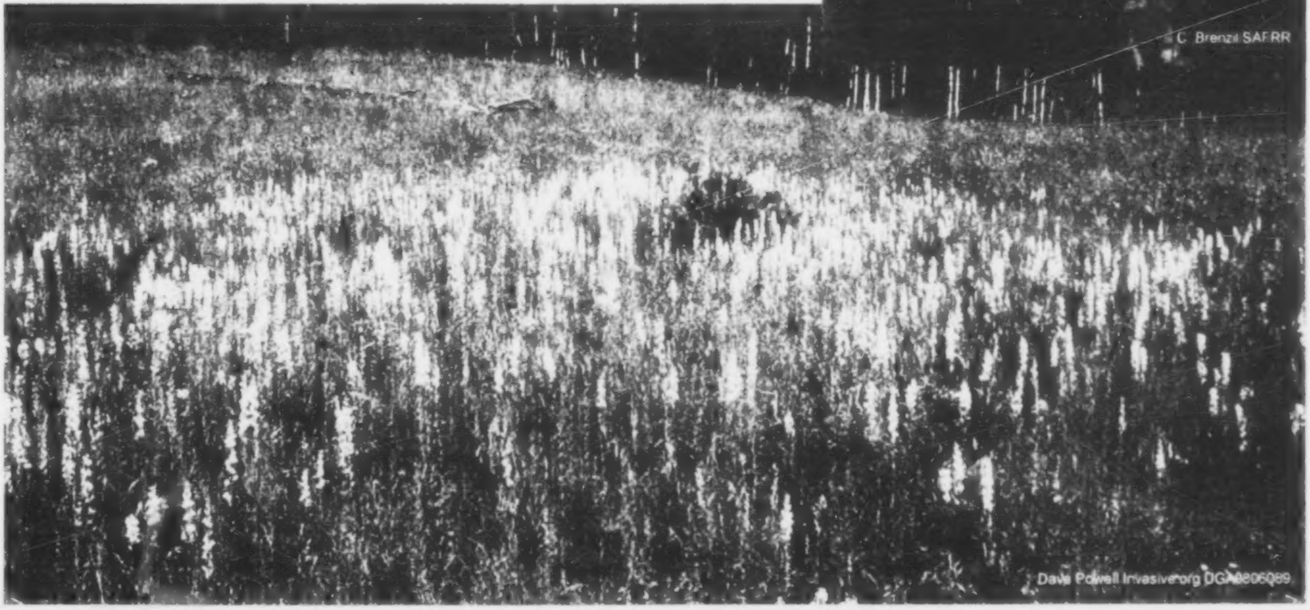
Report small patches immediately to a Weed Inspector

Control by eradication-contain is effective for small patches

Bright yellow-orange flowers with a spur



C. Brenzil SAFRR



Dave Powell Invasive.org DGA806089

If you find this weed report the location to a municipal office or a Weed Inspector

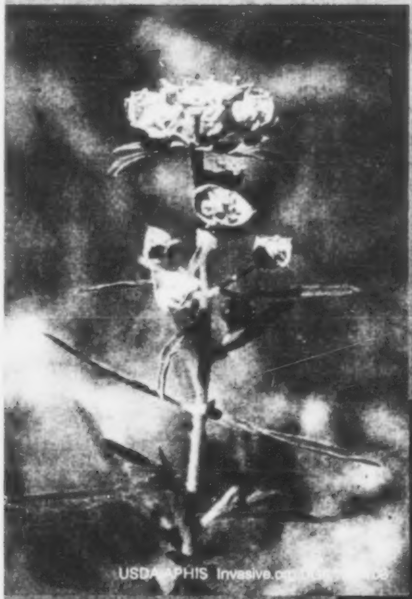
Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization

2004

Wanted Dead to Prevent Spread

Leafy Spurge


USDA APHIS Invasive.org [illegible]

Immediately report small isolated patches to a Weed Inspector

Control by eradication-contain methods are effective for small patches

When this noxious weed covers 80% or more of the soil surface, no forage is available for cattle grazing

Plant contains white latex

Flower has greenish-yellow bracts

[illegible] Invasive [illegible]

Ciesla Invasive.org [illegible] 428096

[illegible]

[illegible]

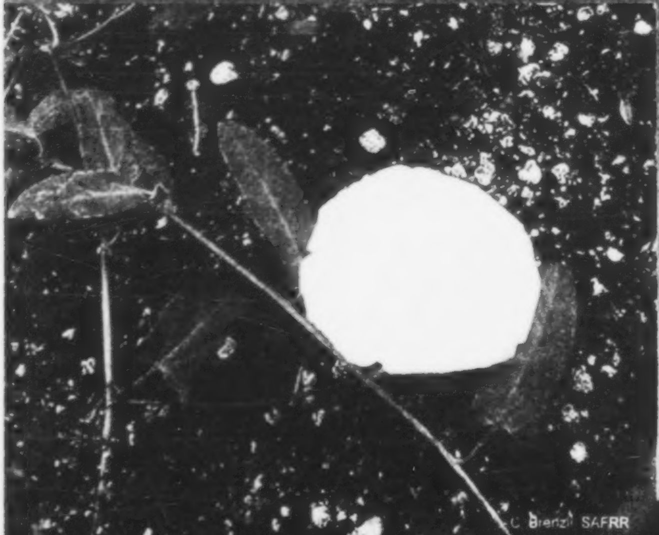
Agriculture Food and Rura Revitalization

Wanted Dead to Prevent Spread

Field Bindweed

Plant has arrow shaped leaves

White-pinkish flowers with long stalks



C. Brenzil SAFRR

A vine that weaves around and over field crop, native and tame forage plants

A mat-like plant that can grow from 0.3 to 2 m a year

Deep-roots rob moisture from desirable plants

Seed remains viable in soil for 20+ years

Immediately report small patches to a Weed Inspector; to start a eradication-contain program

USDA ARS Invasive.org UGA0024081

If you find this weed report the location to a municipal office or a Weed Inspector

Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization

2004

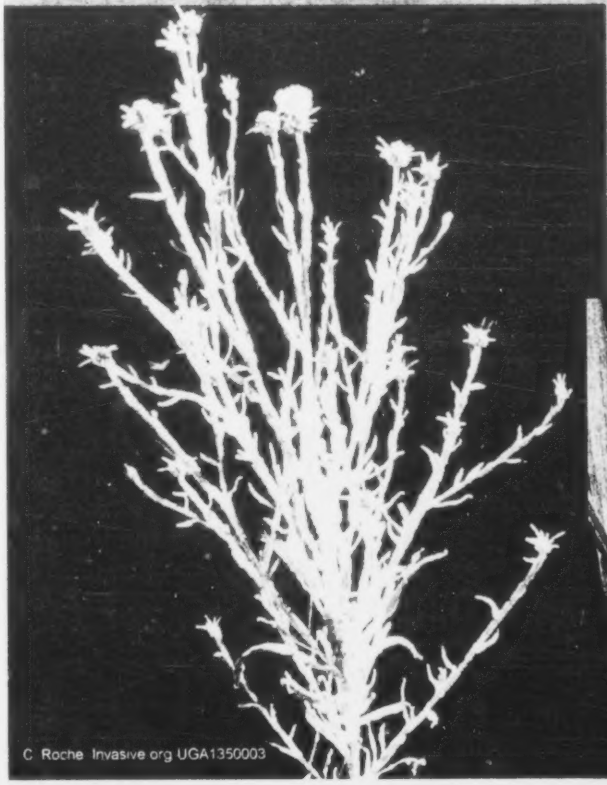
Wanted Dead to Prevent Spread

Field bindweed, leafy spurge and yellow toadflax are invasive plants that are designated noxious weeds.

To promote weed awareness, post 'Wanted Dead to Prevent Spread' posters in public places.

Yellow Starthistle (*Centaurea solstitialis*)

Not known to grow in Saskatchewan

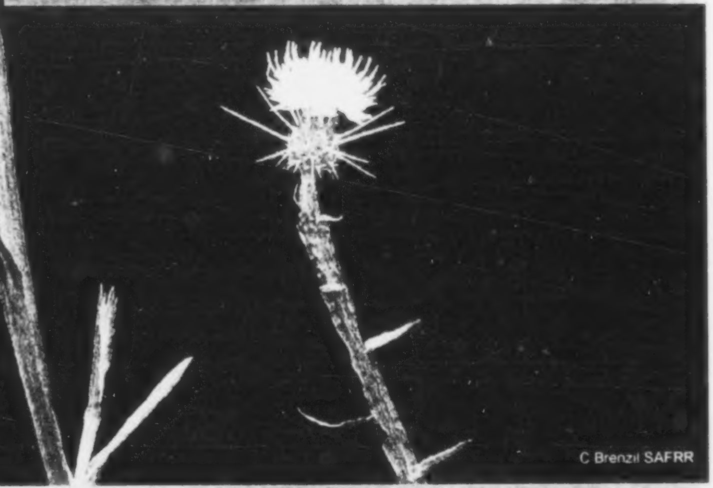


C Roche Invasive.org UGA1350003

Identification

Bright yellow knapweed-like flower with long spines

Winged stem



C Brenzil SAFRR

Photo of a UC [illegible]

C. Roche Invasive.org UGA1360006

Biology and Ecology

Winter annual

Reproduces only by seed

Seeds spread easily by wind, water, animals, humans and vehicles

Causes 'chewing disease' in horses (unable to eat or drink)

Location

Found in Montana, Idaho, North Dakota and Alberta (several patches were found and controlled)

If you find this weed report the location to a Weed Inspector and Provincial Weed Control Specialist 306-787-4673

Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization
2004

Common Crupina (*Crupina vulgaris*)

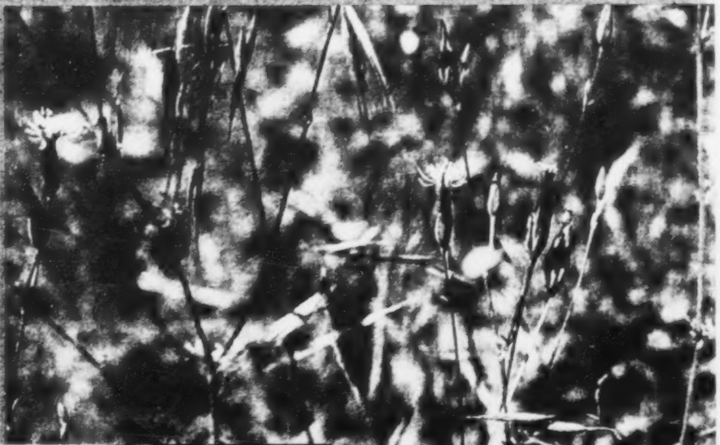
Not known to grow in Saskatchewan

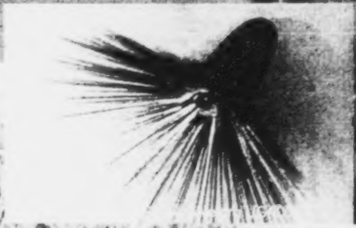
Identification

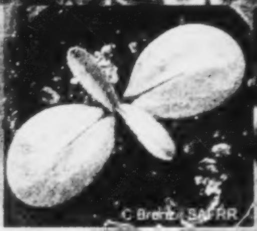
Pink flowers with knapweed-like flowers

Deeply divided leaves with Velcro®-like hooks on the leaf edge

Very large seed (0.6 cm long) with black fringe of hairs (~1.3 cm in diameter)


USDA APHIS Invasive.org UGA1148103




C Brenzil SAFRR

Photograph of an Idaho site

USDA APHIS Invasive.org UGA1148069

Biology and Ecology

Forms dense stands

Unpalatable forage for cattle

Reproduces only by seed

Seeds move by rodents, livestock and human activity

Seeds float on water

Location

Found in Idaho, California, Montana, Oregon and Washington

If you find this weed report the location to a Weed Inspector and Provincial Weed Control Specialist 306-787-4673

SARM Convention 2004 and WITC 2004

Canadian Adaptation and Rural Development Saskatchewan
Agriculture, Food and Rural Revitalization
2004

Plants not known to grow in Saskatchewan

Common Crupina

Yellow Starthistle

Try to retain the identifiable features of these weeds. If you spot one of these weeds, mark it's location and report it. If these weeds ever enter Saskatchewan, they should be eradicated immediately.

Wild Parsnip (*Pastinaca sativa*)

Grows on a few
isolated sites
in Saskatchewan

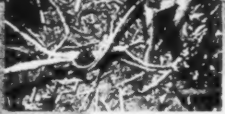
Identification

Resembles dill plant with yellow flowers

Divided leaves with mitten shaped leaflets

Hollow grooved stem

Stout tap root similar to domestic parsnip

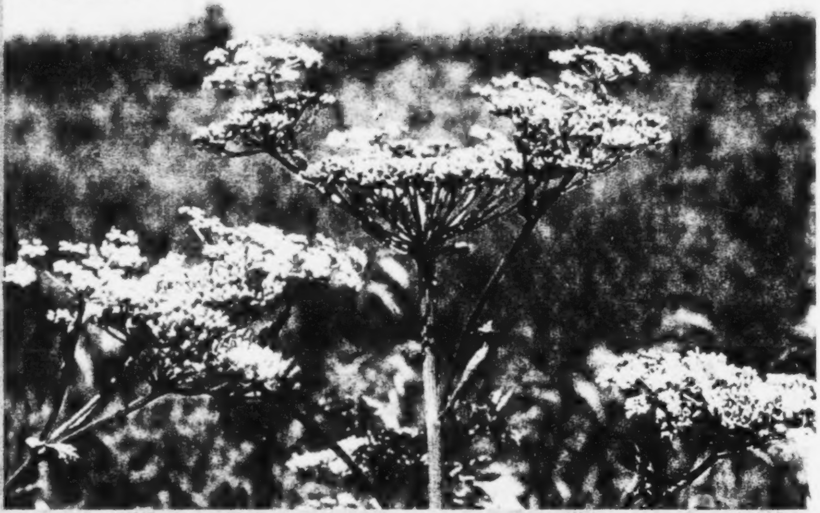


Biology and Ecology

Skin exposed to sap and sunlight can result in a severe burning rash

Handle only with gloves!

Wild parsnip can invade lawns



Location

Populations are established in the Gruenthal area west of highway 11 and in the Kendal area

If you find this weed report the location to a Weed Inspector and Provincial Weed Control Specialist 306-787-4673

Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization
2004

Spotted Knapweed (*Centaurea maculosa*)

Grows on a few isolated sites in Saskatchewan

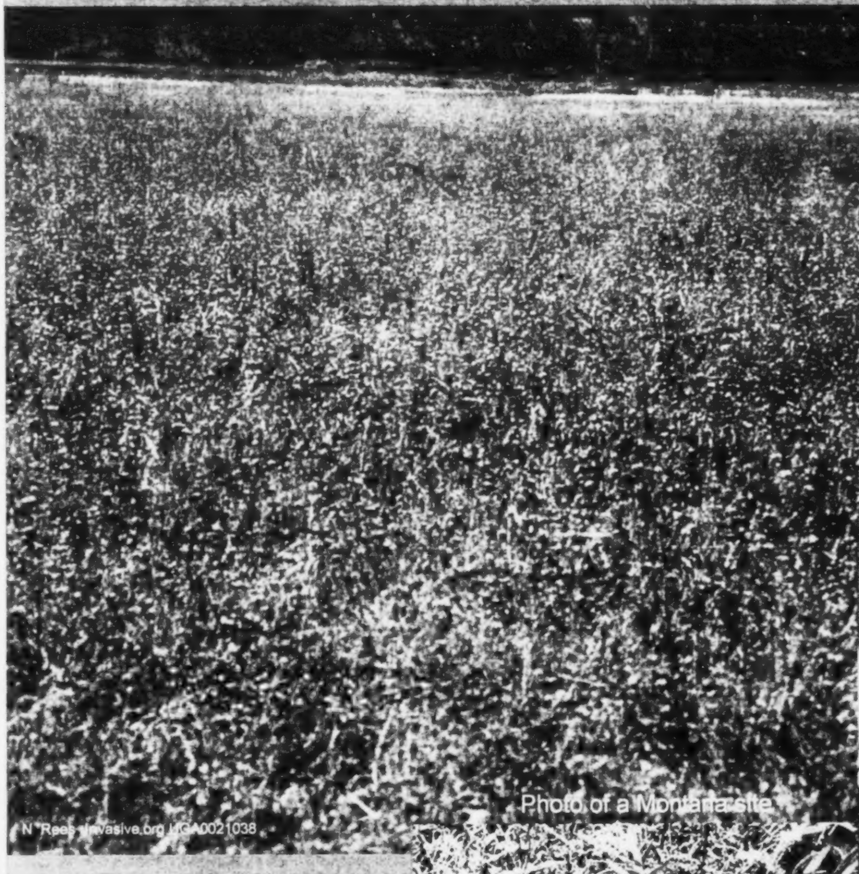


Photo of a Montana site

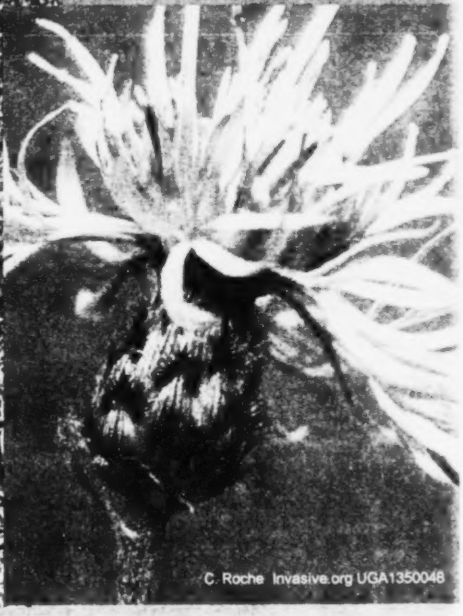
N. Rees Invasive.org UGA0021038

Identification

Deeply lobed, twice-divided basal leaves

Flowers are whitish-pinkish or purplish

Oval bracts with a black-tipped fringe



C. Roche Invasive.org UGA1350048

L. Wilson Invasive.org [illegible]

Biology and Ecology

A perennial

Invades disturbed areas

Reproduces from seed and a taproot

Low palatability

Seeds usually fall within a 30 -120 cm of the plant

Seed spread by water, animals, humans and vehicles

Location

Spotted knapweed is found In Caronport, Chaplin, Rockglen, West Poplar and two sites in Regina

If you find this weed report the location to a Weed Inspector and Provincial Weed Control Specialist 306-787-4673

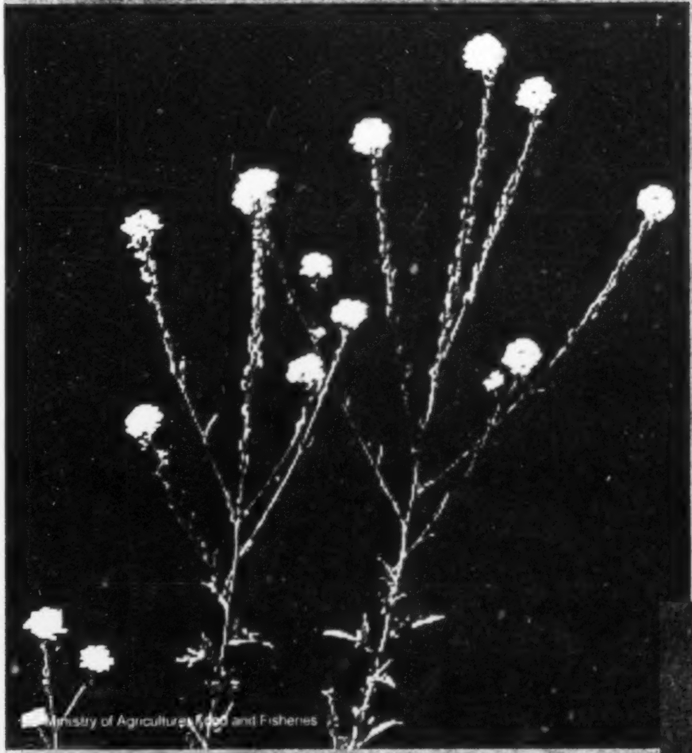
CARDS Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization

2004

Hoary Alyssum (*Berteroa incana*)

Grows on a few isolated sites in Saskatchewan


Ministry of Agriculture, Food and Fisheries

Identification

Annual with white flowers

Dense star-shaped hairs on plant

First leaves are long-stalked in a rosette

Stem leaves are stalk-less and non-clasping

Rounded seedpods with a beak

Biology and Ecology

Reproduces only by seed

Common on sandy soils

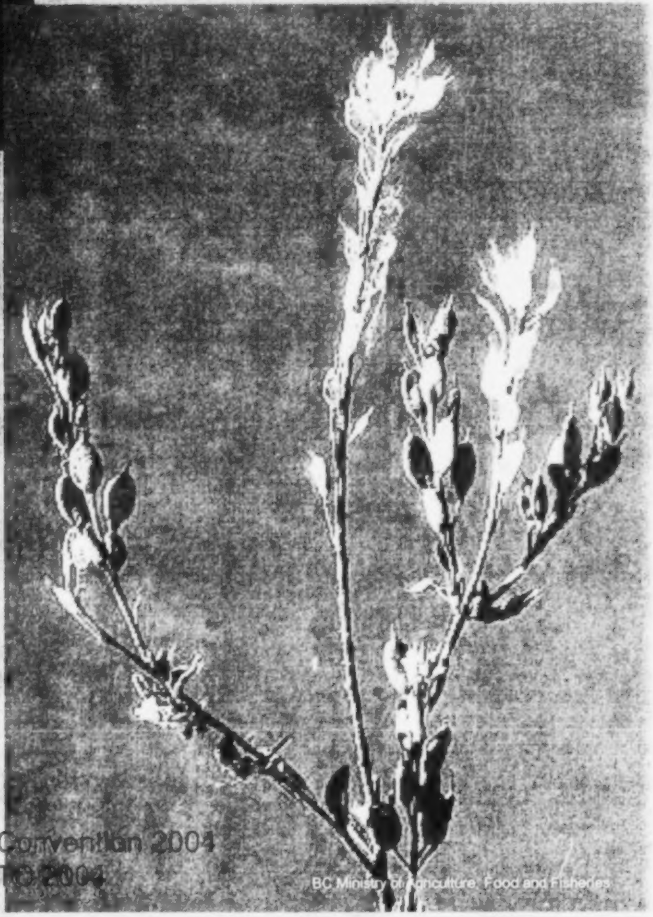
Found in pastures, roadsides, waste areas and disturbed sites

Little to no feed value for livestock

Can be poisonous to horses

Location

North of Prince Albert


BC Ministry of Agriculture, Food and Fisheries

SARM Convention 2004
and WITC 2004

If you find this weed report the location to a Weed Inspector and Provincial Weed Control Specialist 306-787-4673

CARDS Canadian Adaptation and Rural Development Saskatchewan
Agriculture, Food and Rural Revitalization
2004

Plants that grows on a few isolated sites in Saskatchewan

Hoary Alyssum
Spotted Knapweed
Wild Parsnip

Spotted knapweed is a noxious weed.

To help spot these weeds, easily identifiable features are presented. Photos, along with biology and ecology, show potential loss.

Yellow Toadflax (*Linaria vulgaris*)

Grows on many isolated sites in Saskatchewan

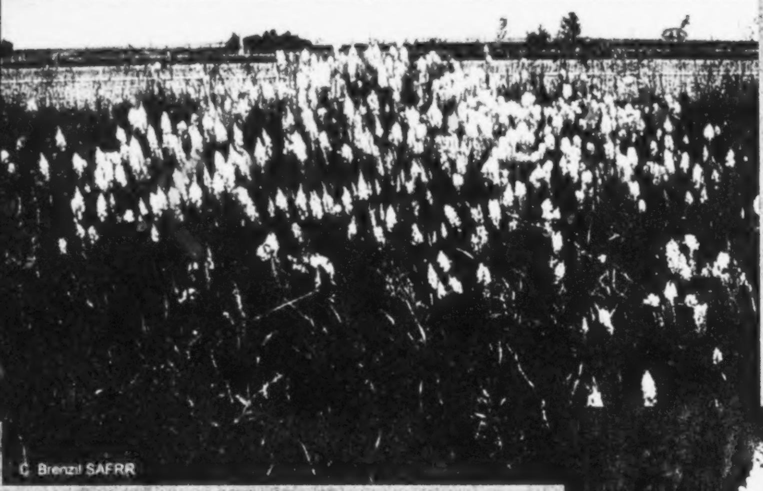
C. Brenzil SAFRR

Identification

Bright yellow and orange flowers that are "snapdragon-like" with a spur below

Linear leaves that are narrower at each end

Clear sap



C. Brenzil SAFRR

Biology and Ecology

Mildly poisonous to livestock

Found in patches

Creeping roots

Invades annual crop land, pastures and native communities

Location

Yellow toadflax is found in northwest Saskatchewan and in many isolated areas

C. Brenzil SAFRR

If you find this weed report the location to a municipal office or a Weed Inspector

Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rura Revitalization

2004

Leafy Spurge (*Euphorbia esula*)

Grows on many isolated sites In Saskatchewan

Identification

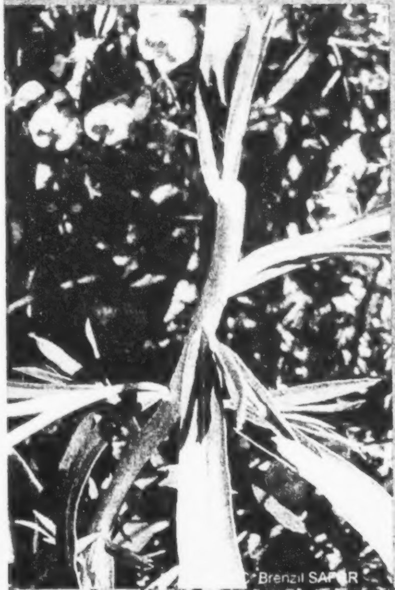
White latex in all plant parts

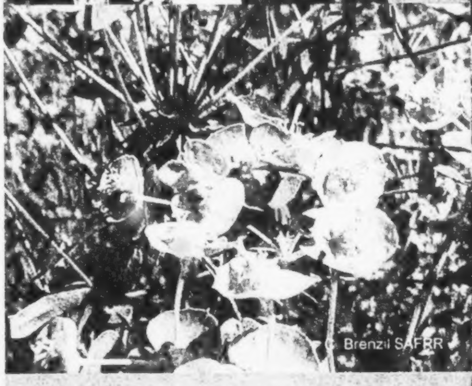
Linear shaped leaves with smooth margins

Crown produces several shoots giving the plant a clump-like appearance, growing in patches

Crown and lateral roots have pinkish-red buds

Green-yellow bracts under the flower-seed


Brenzil SAFRR


Brenzil SAFRR

D.Fontaine/SAFRR

Location

Found near Estevan, Mortlach, Meyronne and many isolated areas in the province

Biology and Ecology

Long-lived, deep-rooted, aggressive perennial plant

Cattle grazing loss can be 100%

Seed pods explode, catapulting seed up to 5 m

Seedling reproduce vegetatively 7 - 10 days after emergence

If you find this weed report the location to a municipal office or a Weed Inspector

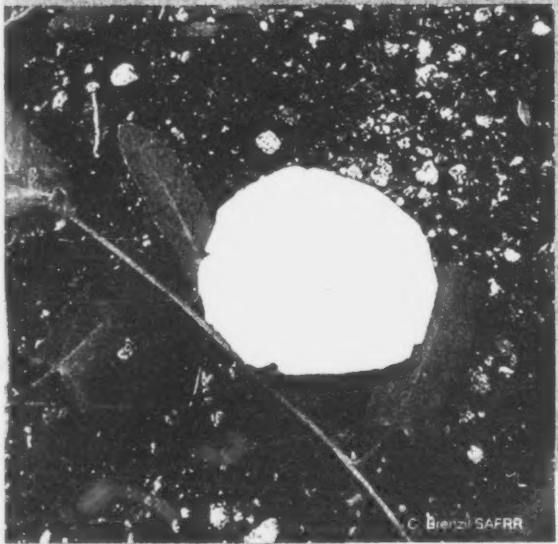
CARDS Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization

2004

Field Bindweed (*Convolvulus arvensis*)

Grows on many isolated sites in Saskatchewan



C. Brenzil SAFRR

Identification

Twining stems (counter-clockwise)

Elongated arrow-shaped leaves with blunt tips

Funnel-shaped flowers – 1 inch across

White to pinkish flowers with long stalks

Biology and Ecology

Deep-rooted perennial weed

Spreads by seed and root fragments

Buds on roots can send up shoots

After 28 years in soil, seed can germinate

C. Brenzil SAFRR

Location

Field bindweed is found sporadically throughout the province but in higher numbers south of the South Saskatchewan and Qu'Appelle rivers

If you find this weed report the location to a municipal office or a Weed Inspector

CARDS Canadian Adaptation and Rural Development Saskatchewan

Agriculture Food and Rural Revitalization 2004

Record of Noxious Weed Control

For effective and consistent noxious weed control, maintain a record of the location for all weed sites and the treatments used to control weeds.

- Record weed site locations using legal descriptions, GPS readings and/or area sketches when a noxious weed is first found.
- Good records help to locate a weedy area for future treatments and monitoring.

Record of Noxious Weed Control is a long term record keeping system. Fill in the parts on the form that are needed to maintain a consistent record of operations in your municipality.

Weed Site Information should be completed to help anyone find treated sites. When herbicides effectively control weeds, sites are difficult to find.

Description and Size of the Weedy Area is needed to document how well weed control practises are stopping weed spread. A sketch of a weedy area is an excellent way to describe the extent of the weed problem.

Choose between:

1. Patch weed control.
2. General road right-of-way spraying.
3. General municipal weed control.

Record of Weed Control Treatments should be recorded when someone other than a Weed Inspector controls noxious weeds. This is part of a long term record of weed control and help to evaluate treatment performance.

Herbicide Applicator Treatment Record should be completed by Weed Inspectors when they apply herbicide treatments. Information on treatment conditions helps to identify best performance conditions, documents products used and aides in settling distributes.

Record of Noxious Weed Control is a long term [illegible] system. Fill in the parts on the form [illegible] to maintain a consistent record of [illegible] your municipality.

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Record of Noxious Weed Control

Date: Month/Day/Year
RM No. and Name:
Weed Inspector Name:
Page A No.

Weed Site Information

Land Occupier:
Address:
Legal Location:
GPS Waypoint No.: N W

Description and Size of the Weedy Area

Enter suitable information to describe the weedy area in Part B. This discription is used for many purposes. A good sketch and GPS reading helps to find the noxious weed in the future. Estimating Land Type, Weed Cover and Size is vital to documement weed spread and increase. This information is critical for the support of new weed programs. A GPS reading is the first step to weed mapping. The next step is using GPS to define the shape of the weedy site.

Record of Weed Control Treatments

Biological Control
New Release(s): Contact Person name and phone number:
New Release(s): Agent Name and Release Date:
Enter the name(s) of past agent release(s):

Herbicide Name and Application Date(s):
Mowing Treatment Date(s):
Other Treatments and Application Date(s):

Herbicide Applicator Treatment Record

Weed Inspector Complete: Applicator Name:
Applicator Licence No.

Complete secton below only when a Weed Inspector has applied a herbicide

Herbicide:
Active Ingredient:
Total Product Used:
PCP No.:
Time of Application:
Application Rate:
Time to Complete:
Soil Type:
Method of Application (include nozzle pressure, carrier volume):
Weather at Application (temperature, wind speed, wind direction, humidity, cloud cover):
Problem(s) Encountered:
Results of Treatment:

Signature: $

Photocopy this document as needed

Description and Size of the Weedy Area

Use 1, 2 or 3 to help describe the extent of the noxious weed that is being controlled. 1. Patch weed controlled to prevent spread, 2. General road right-of-way spraying or 3. General municipal weed control.

Page B No.

1. Patch weed control.

Weed Name

Land Type	Weed Cover	Size	Land Type	Weed Cover	Size	Land Type	Weed Cover	Size

Select a code that best fits the **Land Type: A** = agriculture, **I** = industrial, **R** = road right-of-way, **W** = waterway, **Z** = acreage.

Estimate **Weed Cover** to the nearest 10% between 20 and 80, the nearest 5% from 80 to 95 and 5 and 20, and to the nearest 1% between 0 to 5 and 95 to 100.

Enter the Size of the weedy area or patch.

Enter method of size measurement: Estimate ___ GPS shape ___ Tape - Wheel ___ Other ______________

Comments:

2. General road right-of-way spraying. Write in the names of weeds found on the right-of-way. After a weed, enter a code that best fits the **Weed Cover** on the right-of-way.

Make a sketch of the weedy area

3. General municipal weed control. Mark weedy patch locations on a map of your municipality. For each patch that is marked on the map, enter a code that best fits the **Land Type** and **Size**. For multiple patches record **Weed Cover**.

Photocopy this document as needed

Noxious Weed GPS System

DO YOU HAVE A NOXIOUS WEED PROGRAM IN YOUR RM?

Four local RM's through the District # 43 ADD Board joined together to bring a program with a GPS and Palm Pilot to map, identify and record chemical treatment for the noxious weeds.

They used this system through one weed inspector. They are now offering you the system and education for your weed inspector to implement a program for your RM.

The plan has a GPS and palm pilot system together with education and technical support for the inspector and RM administrator.

The technical system allows your inspector to map a location of the noxious weed then have that point to reference back to when control time comes.

The system allows the inspector to put in the type of weed and also a brief description of the type of chemical used. There is also space available for the day, wind speed and direction of wind so if there is ever any question from a RM taxpayer then the information is readily available for all parties to look at.

The education comes from seminars and workshops that show weed pictures and growth habits, and give an understanding of control measures through both chemical and biological means to control the noxious weed(s) that your RM may have. Also technical support and education for the computer system and how to run the program and GPS unit are also part of the package you purchase.

Paper system is also available for more detail to be in place to assist with mapping and relocation.

The system is as follows:

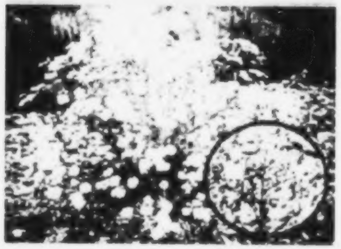
One Garman GPS and Palm pilot system with computer programs to utilize the mapping points that the weed inspector develops

Training for weed inspectors and RM administrators on weed identification and using the GPS and palm pilot system.

The cost of the system is 2599 + taxes and mileage for the training day.

Noxious Weed GPS System

Can you identify these weeds?



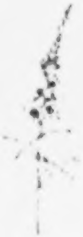
Is there someone in your RM who can? These are noxious Weeds according to the Saskatchewan Noxious Weed Act

If you are interested in creating a plan for your RM please contact:

District # 43 ADD BOARD through,
Extension Agrologist
Nancy Gray, P AG.,
Watrous Rural Service Centre
946-3232 or
ngray@agr.gov.sk.ca

DISTRICT # 43 ADD BOARD
Presents:

NOXIOUS WEEDS PLAN



Creating a plan and educating your weed inspector for your RM to control and implement the Noxious Weed Act

Let Research Answer Your Questions

Recent scientific research articles contain information that can answer some of the questions that are often asked by Weed Inspectors.

1. How well is biological control working?
2. Will viable leafy spurge seed pass through the digestive tract of sheep?

P. Harris, AAFC

Black Dot Spurge Flea Beetle
(*Aphthona nigriscutis*)

Release 1000^+ beetles per release point

Coarse dry to very dry soils

Soil warmed by direction (south) or lack of ground cover

Spurge density $<60/m^2$

Black Spurge Flea Beetle
(*Aphthona lacertosa*)

Release 1000^+ beetles per release point

Moist loam to clay soils

Competing vegetation taller than leafy spurge

Will Viable Seed of Leafy Spurge Pass Through the Digestive Tract of Sheep?

At Montana State University, sheep were fed leafy spurge seeds at the soft dough, hard dough and mature stages of development. Manure was collected every 24 hours. Seeds were recovered, counted and tested for germination.

In the field, leafy spurge seeds do not mature at the same time. Soft dough seeds collected on June 24th contained 25% mature seed. Hard dough seeds collected on July 19th contained 80% mature seed. Mature seeds collected on August 10th were 100% mature.

Hard Dough Stage	1	4	15	41
• Most capsules were hard and difficult to cut by fingernail	2	1	7	0
	3	0	3	0
• 1.5% of the fed seed was recovered	4	1	2	10
	5	0	0	0
Mature Seed	1	0	24	81
• 3.8% of the fed seed was recovered	2	0	71	36
	3	0	10	0
	4	0	3	0
	5	0	1	0

Conclusion and Recommendation: Sheep pass a small percentage of viable seed through their digestive tracts. Do not move sheep until all leafy spurge viable seeds have passed, conservatively 4 – 5 days.

Adapted from B.E. Olson and R.T. Wallander JRM 2002 Vol. 55: 65-69

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[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Viable seed will germinate in the future

Conclusion and Recommendation: Sheep pass a small percentage of viable seed through their digestive tracts. Do not move sheep until all leafy spurge viable seeds have passed, conservatively 4 – 5 days.

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Recovery of Leafy Spurge Seed from Sheep

In south western Montana, Targhee sheep were twice rotated through paddocks that contained leafy spurge.

Fresh manure was collected 4, 10 and 14 days after sheep entered a paddock. The manure was dried and washed over sieves to recover leafy spurge seeds. The seeds were counted and tested for germination.

Manure collected per animal per day contained seeds during the June 17th, July 14th and July 29th grazing periods. The number of viable seed excreted daily per animal ranged between 0 and 17.

The percentage of viable seeds collected from manure was always lower than for seeds collected directly from leafy spurge.

Seeds of leafy spurge that are consumed and passed through the digestive tract may enhance the dispersal of the weed.

Leafy Spurge Seed Recovered from Manure of Sheep		
Date	Seeds/ Animal/Day	Viable Seeds
Sheep entered paddock June 27th		
30 June	41	0
8 July	88	9
13 July	46	0
Sheep entered paddock July 14th		
17 July	144	7
25 July	114	17
Sheep entered paddock July 29th		
31 July	41	8
8 Aug	41	0

In October, the sheep were shorn and seeds were recovered from the fleeces.

Leafy Spurge Seed Recovered from Fleeces		
Sheep Number	Fleece wt. kg	Seeds in Fleece
1	2.7	0
2	2.6	129
3	2.7	0
4	2.7	29
5	3.1	0
6	2.4	74

Sheep grazing leafy spurge during a grazing season will pick up seeds in their fleece.

Three fleeces contained leafy spurge seeds and three did not. The authors believed that the crimped nature of wool would cause seeds to adhere to the wool fibres and become embedded. Seed may drop before becoming embedded but once embedded, seeds would most likely fall out during shearing and processing.

Conclusion: When using sheep to control leafy spurge, graze the weed before seed set. If leafy spurge has set seed, do not move sheep from infested areas to uninfested areas unless the animals are confined for 5 days.

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8 July	68	9
13 July	46	0
Sheep entered paddock July 14th		
17 July	144	7
25 July	114	17
Sheep entered paddock July 29th		
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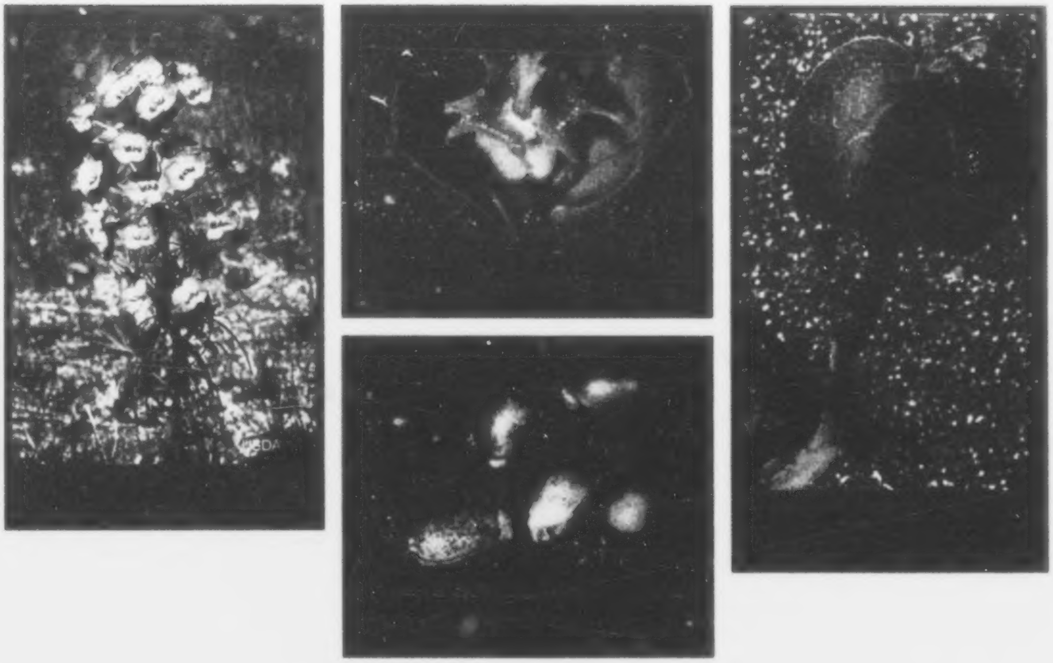

USDA

Leafy Spurge Suppression with Flea Beetles

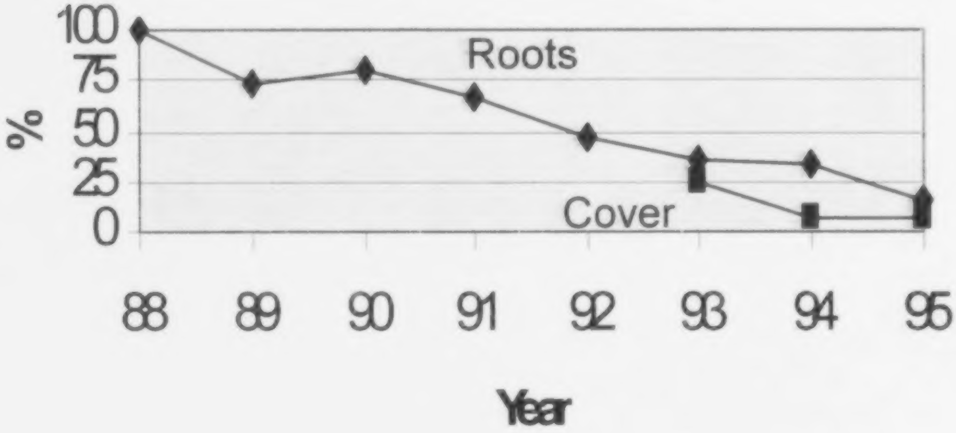
Leafy spurge flea beetles (*Aphthona* spp.) control the weed by suppression. This experiment in east central North Dakota shows how flea beetles released at two sites gradually reduced leafy spurge root weight and foliage cover.

At the first site, flea beetles were released in 1988 and at the second site in 1989.

The soil was a silty clay. Each October, the weight of roots was obtained by using a golf-cup cutter to sample a soil core 15-cm deep in the soil. Leafy spurge roots were separated from the soil, dried and weighed. The cover of leafy spurge foliage was measured at haying time.

Figure 1 shows the loss of root weight by the flea beetles as % loss from the first sample. The reduction in the cover of leafy spurge foliage is expressed as a percent of a nearby patch of leafy spurge where the flea beetles were not found.

Figure 1 % Loss of Root Weight and Foliage Cover After Flea Beetle Release



Conclusions:
- There was a gradual loss of root weight over 7 to 8 years
- After 7 to 8 years, 16% of the roots were alive
- Beneficial foliage cover reduction did not occur until 5 years after insect release
- After 7 to 8 years, leafy spurge foliage covered 6 to 7% of the soil surface

Be patient, effective biological control takes a long time

Dr. Kirby, Professor, Animal and Range Sciences Department, North Dakota State University writes: 'The results of this study should not be interpreted too broadly'.

He goes on to say: "*Aphthona* spp. (Leafy spurge flea beetle) establishment in sandy soils, overflow or subirrigated range sites and in shrubby or riparian areas have not been successful to date".

For successful beetle establishment select sites with silty clay soil that are not close to flowing water or in a mixed leafy spurge – shrubby vegetation community.

Adapted from an article by Kirby et al 2000 JRM 52: 305-308

A leafy spurge site in the province with established black dot and black flea beetles. The beetles are doing a good job of suppressing leafy spurge in the flood plain except along the stream bank.

Healthy leafy spurge plants are growing along the stream bank

Biological Control of Leafy Spurge with Beetles

In two separate experiments, black dot and black flea beetles were released on medium density stands (~40 stem/m^2) of leafy spurge.

Beetles were collected and released on the same day. The average sand-silt-clay was 44-37-19 at the black dot flea beetle release sites and ranged from 11:67:22 to 50:38:12 at the black flea beetle release sites.

Each year stem density was counted, compared to stem density at nearby sites with no beetles and tabulated as percent stem decline. Each year during peak beetle emergence, the adults were collected in a sweep net (38 cm diameter sweep net), counted and presented as leafy spurge flea beetle number per sweep (LSB #/sw).

Black Dot Flea Beetle Sites

The number of black dot flea beetles increased from the first year after release to the second year after release, and then remained constant but relatively low to the fifth year after release.

Notice the gradual decline of leafy spurge stems the second year from the release point to 16 m. Also, stems declined from the second to the fifth year at 4 to 16 m.

By the fifth year the decline of leafy spurge ranged from 50 to 70%. In a more recent paper (2002), the same authors reported that once control reached an average of 65% stem reduction that neither leafy spurge control or the beetle population increased during the next 5 years.

In North Dakota, black dot flea beetles are present in every county but there are very few location where their number exceed 5 to 10 beetles per sweep.

Distance from Release Point (metres)	Years After Black Dot Flea Beetle (*Aphthona nigriscutis*) Release								
	1	2		3		4		5	
	LSB #/sw	LSB #/sw	% Stem Decline	LSB #/sw	% Stem Decline	LSB #/sw	% Stem Decline	LSB #/sw	% Stem Decline
Pole			62		64		68		72
0 to 4	1	5	62	7	64	4	58	7	62
4 to 8	4	7	26	7	54	7	59	4	72
8 to 12	3	5	17	1	22	6	48	5	51
12 to 16	1	2	12	5	23	4	36	6	57

LSB #/sw = Leafy Spurge Beetle Number per Sweep with a 38 cm diameter sweep net

Black Flea Beetle Sites

Beetles were found up to 10 m from the release point one year after release.

One year after release there was no decline in leafy spurge stem number.

Near the release point in year 2, the population of black flea beetles increased rapidly. Leafy spurge stem number started to decrease in year 2 and by the third year after release the percentage of leafy spurge stems that declined was impressive.

By year 3 the number beetles per sweep was similar, within 20 m of the release pole.

By year 4, leafy spurge stem reduction was 95% or better.

Distance from release Pole (metres)	Years After Black Flea Beetle (*Aphthona lacertosa/czwalinae*) Release						
	1	2		3		4	
	LSB #/sw	LSB #/sw	% Stem Decline	LSB #/sw	% Stem Decline	LSB #/sw	% Stem Decline
Pole	8	96	51	14	95	102	98
0 to 5	4	103	11	36	91	109	100
5 to 10	1	14		29	61	50	98
10 to 15	0	3		23	36	56	98
15 to 20	0	2		20	37	56	95

LSB #/sw = Leafy Spurge Beetle Number per Sweep with a 38 cm diameter sweep net

Conclusions

In this study black dot flea beetles reduced the stem density of leafy spurge to ~65% but the number of beetles per sweep was always low.

Black flea beetles reduced the stem density of leafy spurge to 95% or better and number of beetles per sweep was high but varied from year to year.

It is important to sample release sites each year and around the time the adults are expected to emerge to find the best time to collect high numbers.

Adapted from Lym and Nelson 2000 Weed Technology 14: 642-646

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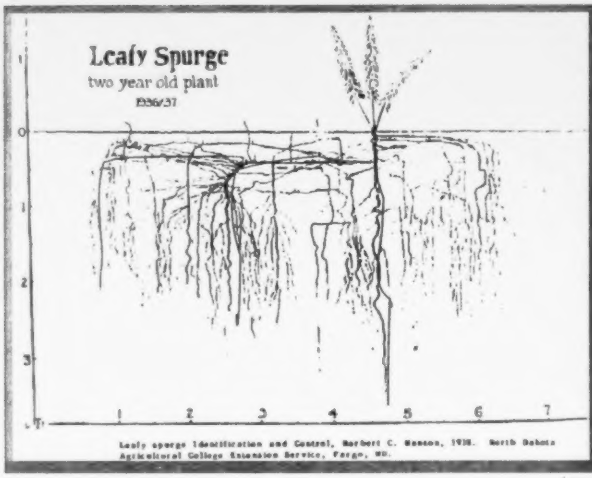
Adapted from Lym and Nelson 2000 Weed Technology 14 642-646

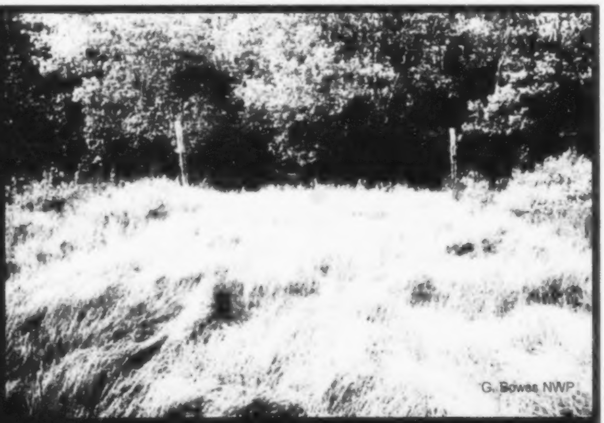
How Does Leafy Spurge Grow



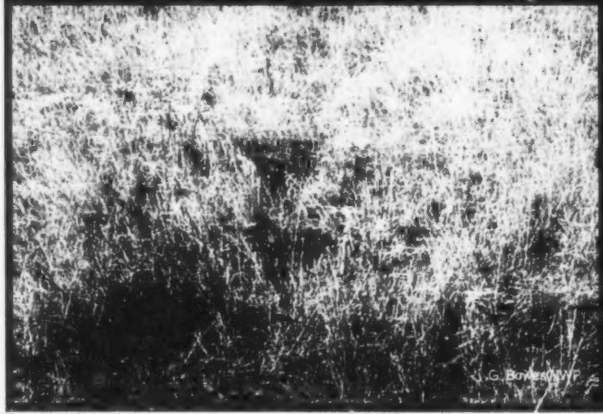
Leafy spurge Identification and Control, Herbert C. Hanson, 1938. North Dakota Agricultural College Extension Service, Fargo, ND.

A two-year old plant has a small amount of above ground growth and a massive root system.

After a seed germinates, a seedling grows deep into the soil (red line). Above ground, leafy spurge does not usually flower the first year. Then a lateral root grows first horizontally and then deep into the soil (green line). From the lateral root (green line), a new root (blue line) or shoot (orange line) can grow.



G. Bowes NWP



G. Bowes NWP

Part 1: Long Term Control of Leafy Spurge with Flea Beetles

Black leafy spurge flea beetles were released in 1996 at the stake.

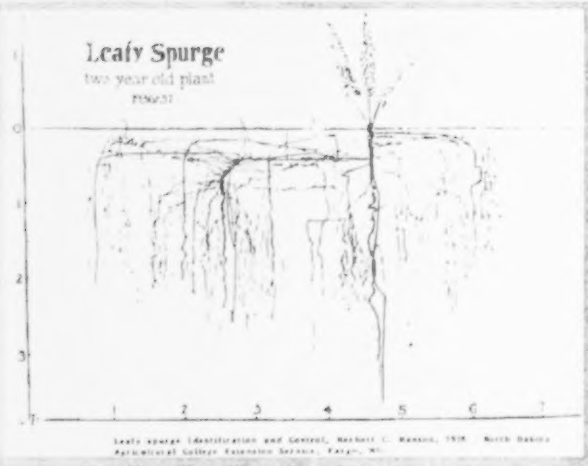
The number of beetles per sweep (sw) are:
☐ 2000: 1/sw
☐ 2002: 5-6/sw
☐ 2003: 7-35/sw
☐ 2004: 3-4/sw
Notice the amount of leafy spurge that is in flower.

[illegible]

[illegible]

Conclusion
On this site, the best time to capture beetles for release at a new site was in 2003. Adult beetle emergence is staggered, so on warm sunny days, start sampling around the first of July for the best collection day. Sweep for beetles during the warmest part of the day. Collect for release when the number per sweep is high.

How Does Leafy Spurge Grow



Leafy spurge Identification and Control, Herbert C. Hanson, 1938. North Dakota Agricultural College Extension Service, Fargo, ND.

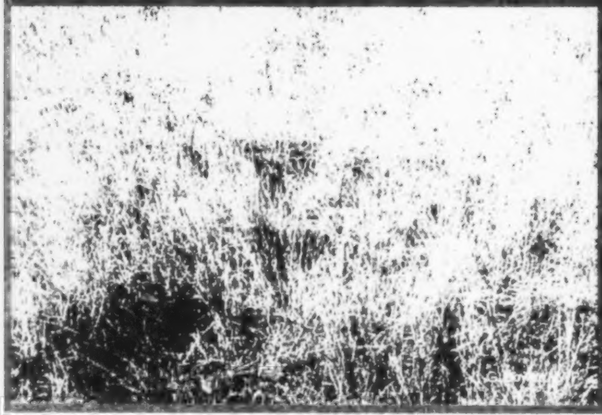
A two-year old plant has a small amount of above ground growth and a massive root system.

After a seed germinates, a seedling grows deep into the soil (red line). Above ground, leafy spurge does not usually flower the first year. Then a lateral root grows first horizontally and then deep into the soil (green line). From the lateral root (green line), a new root (blue line) or shoot (orange line) can grow.

[illegible] This is a huge massive root system [illegible] [illegible] in the soil [illegible] years.

Early detection of leafy spurge gives you the best opportunity for [illegible]

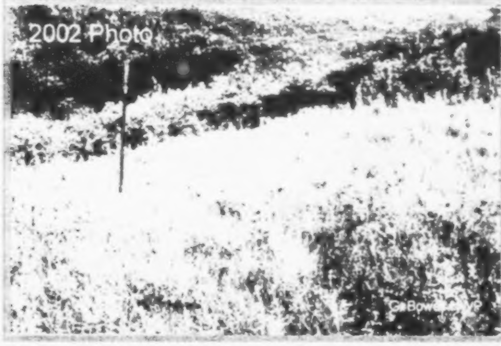
G. Bowes NWP



Look for leafy spurge patches that are small and not well organized. A few stems have set seed. Because the patch looks young, seed set and viable seed deposition in the soil will be minimal.

The opportunity for eradication is [illegible] in the photo on the left [illegible] the photo shows. Because [illegible] seed is known to have fallen on the soil, plan for a 10-year [illegible] program.

Part 1: Long Term Control of Leafy Spurge with Flea Beetles



Black leafy spurge flea beetles were released in 1996 at the stake.

The number of beetles per sweep (sw) are:

- 2000: 1/sw
- 2002: 5-6/sw
- 2003: 7-35/sw
- 2004: 1-4/sw

Notice the amount of leafy spurge that is in flower.

In 2003, there were fewer leafy spurge stems than in 2002 and only a few stems flowered. There is very little yellow in 2003 Photo.

In 2004, only a few stems of leafy spurge appeared and only a few of these stems flowered and set seed.

Conclusion

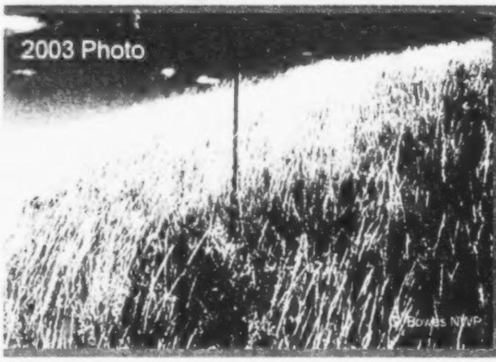
On this site, the best time to capture beetles for release at a new site was in 2003. Adult beetle emergence is staggered, so on warm sunny days, start sampling around the first of July for the best collection day. Sweep for beetles during the warmest part of the day. Collect for release when the number per sweep is high.

Part 2: Long Term Control of Leafy Spurge with Flea Beetles

Black leafy spurge flea beetles were released in 1996.

Number of beetles per sweep (sw) are:

- 2000: <1/sw
- 2002: 0/sw
- 2003: 0/sw
- 2004: 1-3/sw



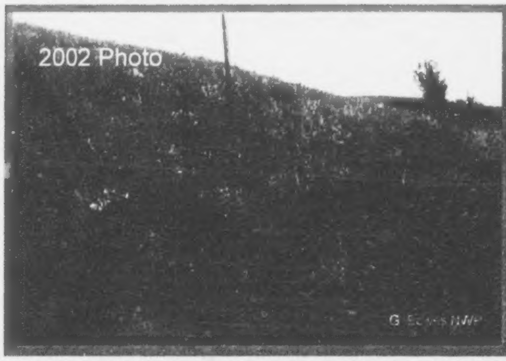
In 2000, several small stems of leafy spurge were found. 2002 Photo and 2003 Photo show that no leafy spurge stems were found near the release point at the stake.

In 2004, a few leafy spurge stems grew near the release stake. Some of these stems flowered and set seed.

Conclusion

Biological control agents like the flea beetles never eradicate leafy spurge. As the food supply (leafy spurge) dwindles, a small number of beetles will be present on the remaining stems. The few stems that are visible in 2004 Photo may have originated from roots that were not consumed by the larval stage of the beetles or seed. As the number of leafy spurge stems increases, the number of beetles will increase. Over time, the number of leafy spurge stems will fluctuate around an equilibrium that depends on the intensity of the beetle attack and the ability of leafy spurge to survive the attack. The equilibrium will fluctuate with environmental conditions.

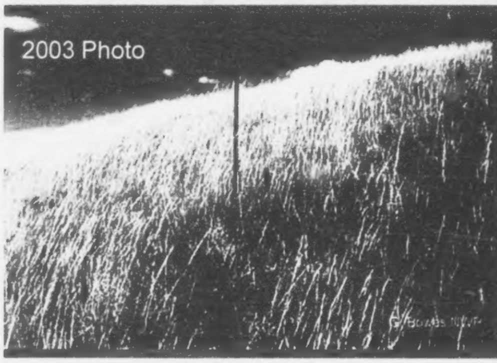
Part 2: Long Term Control of Leafy Spurge with Flea Beetles



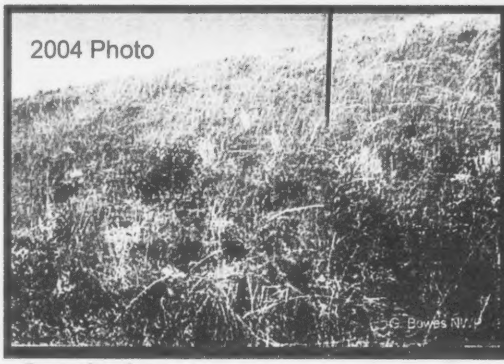
Black leafy spurge flea beetles were released in 1996

Number of beetles per sweep (sw) are:

- ☐ 2000: < 1/sw
- ☐ 2002: 0/sw
- ☐ 2003: 0/sw
- ☐ 2004: 1-3/sw



[illegible]



Conclusion

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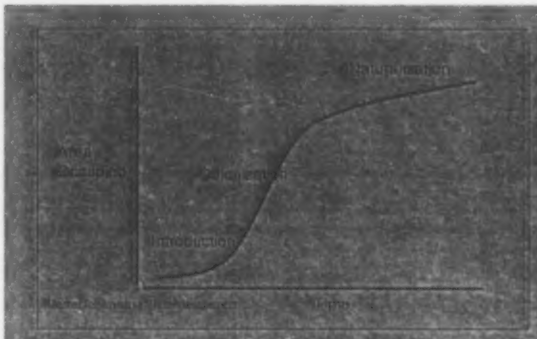
A site in the province with leafy spurge. Notice the continuous infestation of leafy spurge along the road right-of-way and the large patches in the nearby grasslands. An example of a site where there is rapid expansion (colonization) of leafy spurge. Always control small patches of leafy spurge with herbicides when they first appear in your area to prevent a large infestation from happening.

Why Every Municipality Needs a Proactive Weed Inspector

To successfully eradicate or adequately control our worst weeds, they must be found when they first establish. Our worst weeds are declared noxious under the Noxious Weed Act. A Weed Inspector has the authority to enforce control.

A proactive Weed Inspector has the opportunity to eradicate a noxious weed when it is found growing in a small area for only a few years. The fewer the number of seeds in the soil, the better the opportunity for eradication.

When a reactive Weed Inspector reacts to a complaint of noxious weed, it is often found growing in a large area for many years. The only option is ongoing yearly control. Control is difficult because for many of the worst weeds, seeds can remain viable in soil for a long time.



When an invasive plant is **Introduced** to an area it takes time for its occupied area to increase. This is the opportunity for eradication.

Colonization is when there is rapid expansion of the area occupied by the plant. Eradication is next to impossible and the only opportunity is for containment and long time control.

When a plant occupies a large area then it is most likely **Naturalized** and will grow as part of the native vegetation.

When the invasive plant is declared noxious, it falls under the Noxious Weed Act. Land owners are obligated to control the weed and Weed Inspectors enforce the act.

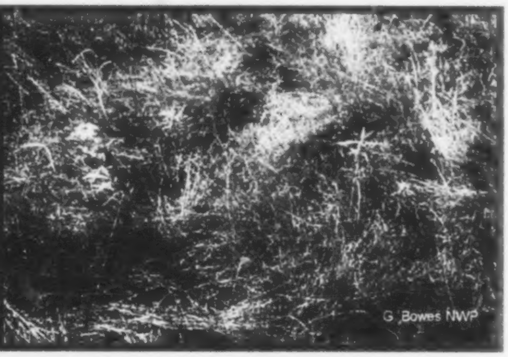
Always Appoint a Weed Inspector to Stop Weed Spread

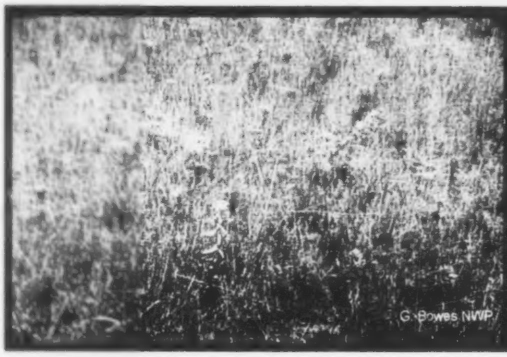
A successful Weed Inspector is proactive. He always looks for new infestations of noxious weeds like leafy spurge and makes plans to eradicate, when possible. Eradication is difficult. The best opportunity for successful eradication occurs when a weed is growing in a small patch for only a few years.

G. Bowes NWP

A single leafy spurge stem looks like a seedling. Usually, one year old seedlings do not flower.

This is the best time to start an eradication program because there has been no seed rain. Isolated leafy spurge stems are almost impossible to find.


G. Bowes NWP


G. Bowes NWP

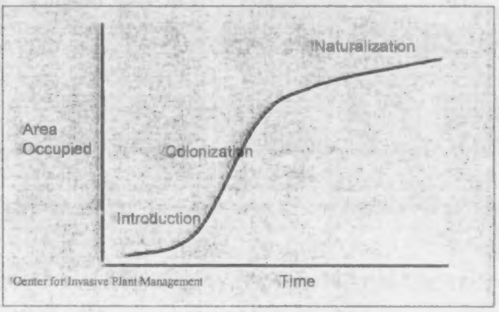
When eradication is started for a two-to-three year old leafy spurge patch, viable seed will have fallen on the soil. Because leafy spurge seed can remain viable in the soil for at least 8 years, a 10-year control program using a residual herbicide is recommended.

Why Every Municipality Needs a Proactive Weed Inspector

To successfully eradicate or adequately control our worst weeds, they must be found when they first establish. Our worst weeds are declared noxious under the Noxious Weed Act. A Weed Inspector has the authority to enforce control.

A proactive Weed Inspector has the opportunity to eradicate a noxious weed when it is found growing in a small area for only a few years. The fewer the number of seeds in the soil, the better the opportunity for eradication.

When a reactive Weed Inspector reacts to a complaint of noxious weed, it is often found growing in a large area for many years. The only option is ongoing yearly control. Control is difficult because for many of the worst weeds, seeds can remain viable in soil for a long time.



When an invasive plant is **Introduced** to an area it takes time for its occupied area to increase. This is the opportunity for eradication.

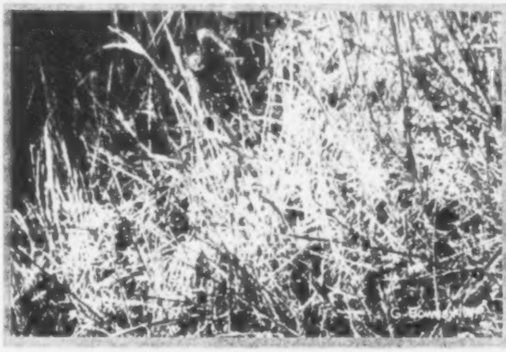
Colonization is when there is rapid expansion of the area occupied by the plant. Eradication is next to impossible and the only opportunity is for containment and long time control.

When a plant occupies a large area then it is most likely **Naturalized** and will grow as part of the native vegetation.

When the invasive plant is declared noxious, it falls under the Noxious Weed Act. Land owners are obligated to control the weed and Weed Inspectors enforce the act.

Always Appoint a Weed Inspector to Stop Weed Spread

A successful Weed Inspector is proactive. He always looks for new infestations of noxious weeds like leafy spurge and makes plans to eradicate, when possible. Eradication is difficult. The best opportunity for successful eradication occurs when a weed is growing in a small patch for only a few years.

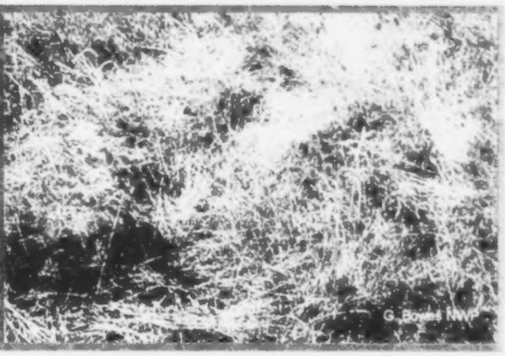


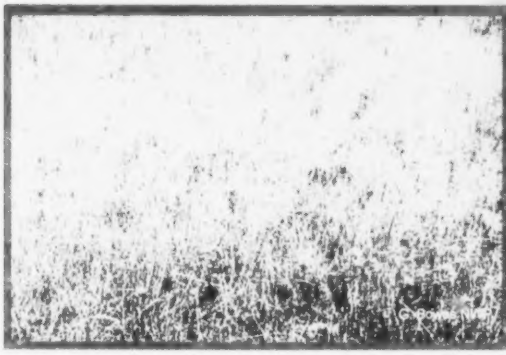
A single leafy spurge stem looks like a seedling. Usually, one year old seedlings do not flower.

This is the best time to start an eradication program because there has been no seed rain. Isolated leafy spurge stems are almost impossible to find.

Two leafy spurge stems (one is flowering) looks like a two-year old or older plant. All of the stems could be connected by a massive root system.

Single flowering stems of leafy spurge can be spotted by a proactive Weed Inspector when walking. Most likely the weed with one flower will be missed when a Weed Inspector is scouting with a vehicle.





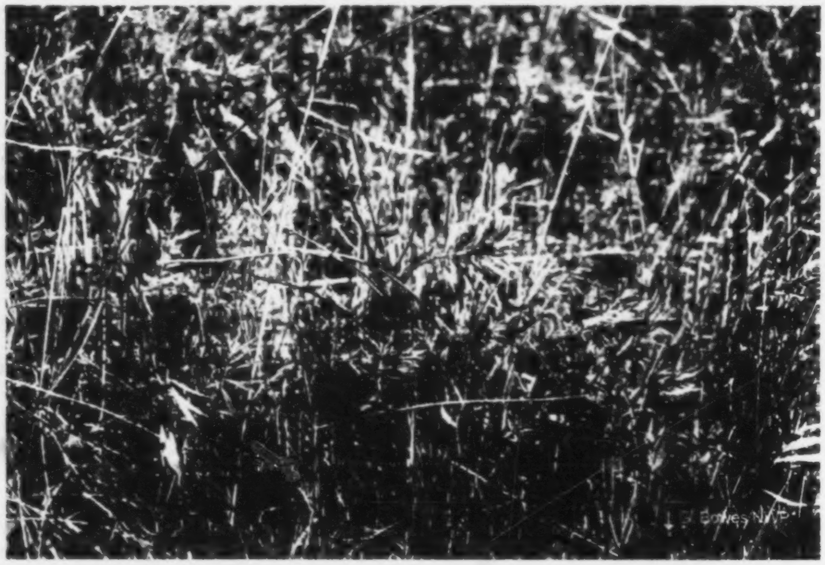
The flowering leafy spurge stem looks like a two-to-four year old or older plant.

Leafy spurge at this growth stage is about when a new patch can be easily spotted. It takes about four years before aggressive lateral root growth starts from a new patch.

When eradication is started for a two-to-three year old leafy spurge patch, viable seed will have fallen on the soil. Because leafy spurge seed can remain viable in the soil for at least 8 years, a 10-year control program using a residual herbicide is recommended.

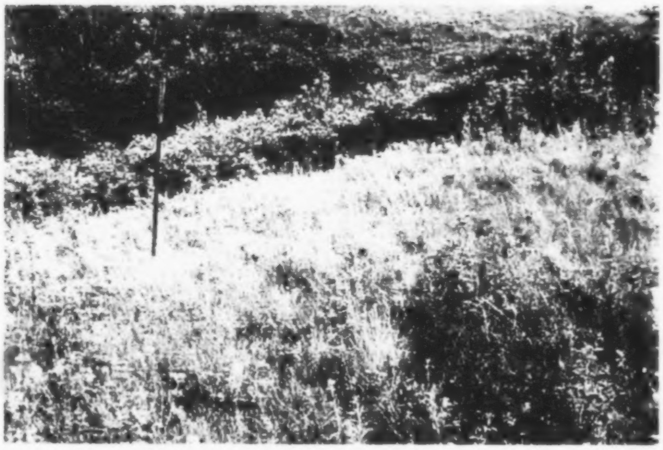
Leafy Spurge in the Fall

Fall can be a good time to scout for leafy spurge because some of stems are crimson red and easy to spot.



There is a tendency for leafy spurge to remain upright in the fall as the surrounding grasses lay on the ground.

Fall is a good time to scout for leafy spurge

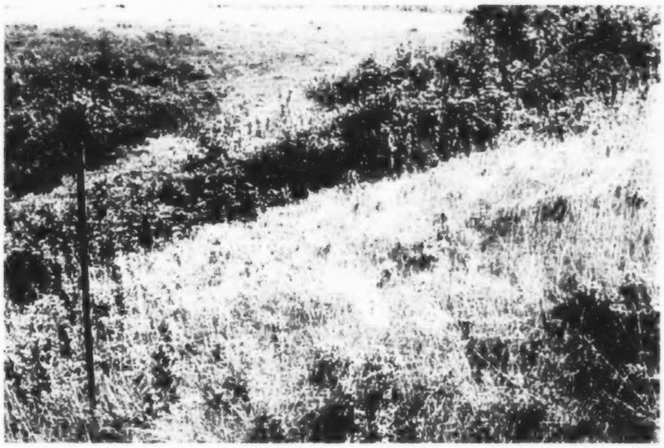


Year of Photo: 2002

Release site number WP 070.
Black leafy spurge beetles were released in 1996.
Number of beetles per sweep (s).
2000: 1/s
2002: 5-6/s
2003: 7-35/s
2004: 1-4/sBl
Note the cover of leafy spurge

Year of Photo: 2003

Cover of leafy spurge in 2003 is less than in 2002.



Year of Photo: 2004

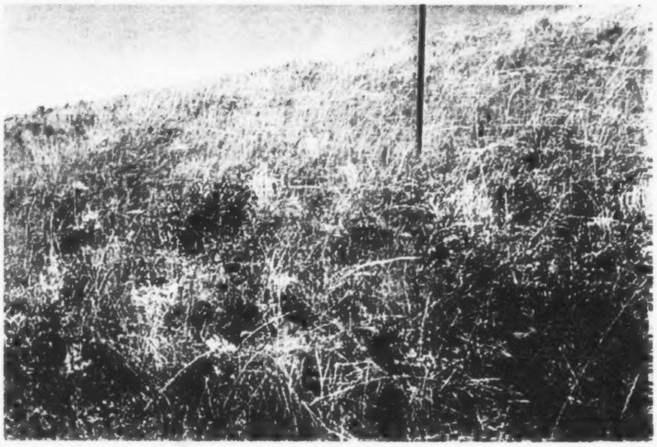
Cover of leafy spurge in 2004 is less than in 2003

Year of Photo: 2002

Release site number WP 070.
Black leafy spurge beetles were released in 1996.
Number of beetles per sweep (s).
2000: <1/s
2002: 0/s
2003: 0/s
2004: 1-3/s Bl
No Leafy Spurge.

Year of Photo: 2003

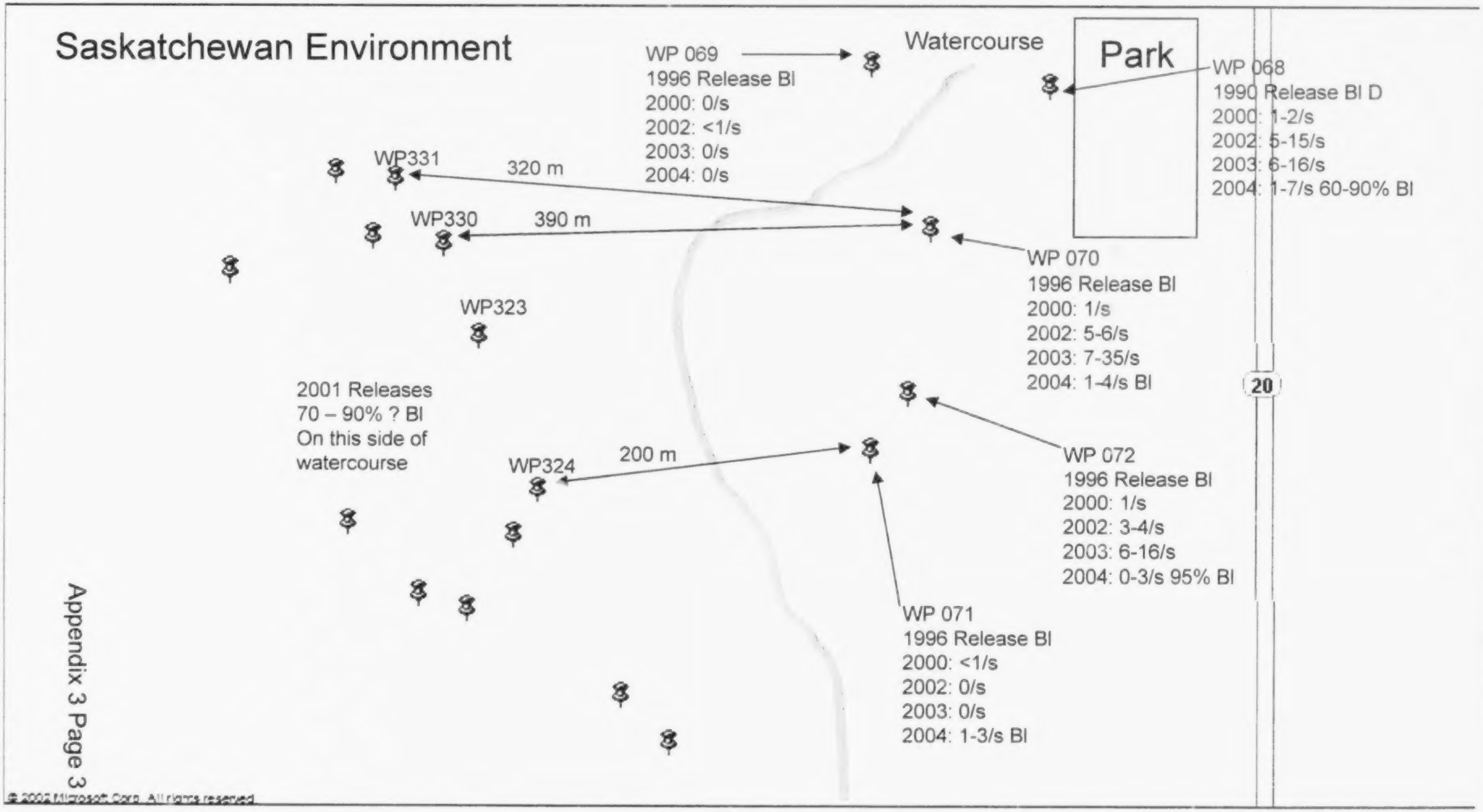
No Leafy Spurge.



Year of Photo: 2004

A few leafy spurge plants present.

Area Map. Pushpin locations are GPS readings and other markings on the map are drawings.



Appendix A

Saskatchewan
Environment

Application for Permit: Chemical Control of Aquatic Nuisances in and/or Near Surface Water

In accordance with Clause 35(1)(b) of *The Environmental Management and Protection Act, 2002* a permit is required if pesticides are to be applied to any surface watercourse in Saskatchewan. This includes intermittent waterways and drainage ditches, even when dry and areas up to 50 metres from the water's edge. The only exceptions are non-draining water bodes, such as dugouts, which are wholly contained on private land. To be exempt, such water bodies must not discharge surface water at any time to adjacent properties or waterways. I hereby apply for a permit.

1. Name of Applicator ____________________ Applicator's Licence #: ____________

   Address ____________________ Postal Code: __________
   Telephone: __________

2. Chemical to be applied on behalf of ______________________________ (person or agency)

3. Purpose of treatment:
   ☐ Algae ☐ Insects (specify) ____________________
   ☐ Emergent Plants (e.g. Cattails)
   ☐ Submergent Plants ☐ Other (specify) ____________________

4. Chemical** to be used (product name and product registration #) ____________________

5. Dosage Rate: ____________________

6. Size of area to be treated: ____________________ Average depth: ____________

7. Total amount of chemical to be applied: ____________________

8. Number of times chemical to be applied: ____________________

9. Method of chemical to be applied by: ____________________

10. Period of treatment: ____________________ to ____________________

11. Name or location and description of water body to be treated (attach a sketch plan): ____________________

12. List major water users (including fish/wildlife) that may be affected: ____________________

13. I agree to follow instructions outlined by the manufacturer with specific reference to the rate of application, concentration of the chemical applied and safety factors related to the application.
14. I understand and agree that any permit granted is valid only within the calendar year of issue, unless otherwise stated on the permit and is subject to cancellation at any time at the department's discretion.
15. In consideration of the granting to me of a permit to apply chemicals, I hereby undertake to save harmless and agree to indemnify the Province of Saskatchewan, its officers and employees from and against all damages, losses, costs, charges and expenses which the province, its officers and employees may sustain or incur or be liable for in consequence of such claims or demands, or of its having granted to me a permit to apply chemicals.
16. I certify that the information contained in this application is true, complete and accurate.

Signature of Applicant: ____________________ Date: ____________________

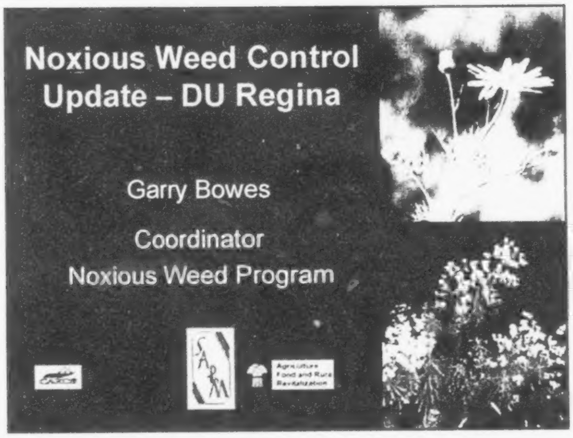
Fully complete above and submit to:
Saskatchewan Environment (SE) OR Your nearest SE Ecoregion Office
Environmental Protection Branch
Room 224, 3211 Albert Street
REGINA SK S4S 5W6

Office Use Only

Permit Granted: ____________________ 20____. Permit No.: ____________________

* Please allow approximately 20 working days for processing.
** Only one chemical per permit. This form may be photocopied.

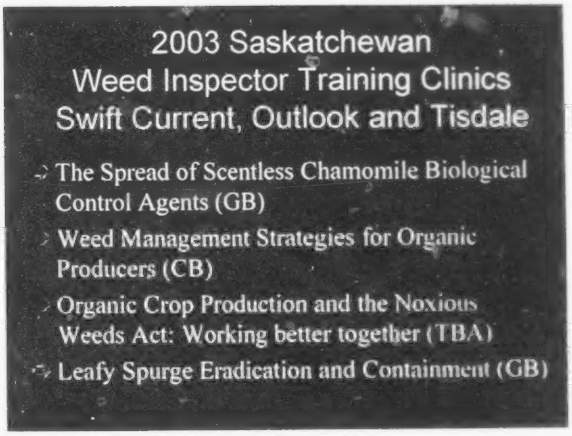
Reference:
A Guide to Aquatic Nuisances and Their Control
November 2002
EPB 47



Noxious Weed Control Update – DU Regina

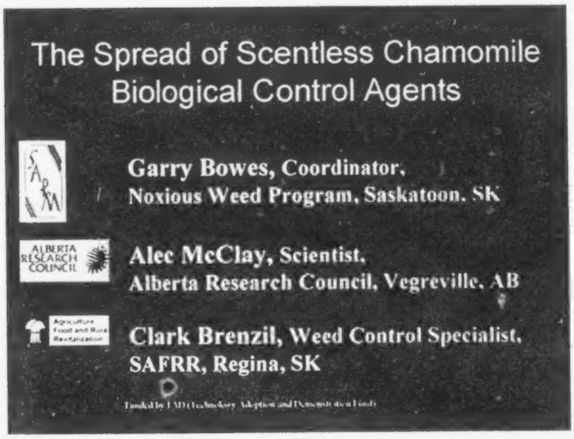
Garry Bowes

Coordinator
Noxious Weed Program



2003 Saskatchewan Weed Inspector Training Clinics Swift Current, Outlook and Tisdale

- The Spread of Scentless Chamomile Biological Control Agents (GB)
- Weed Management Strategies for Organic Producers (CB)
- Organic Crop Production and the Noxious Weeds Act: Working better together (TBA)
- Leafy Spurge Eradication and Containment (GB)



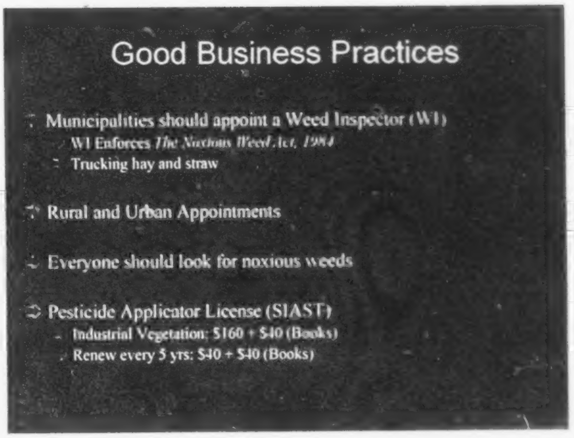
The Spread of Scentless Chamomile Biological Control Agents

Garry Bowes, Coordinator,
Noxious Weed Program, Saskatoon, SK

Alec McClay, Scientist,
Alberta Research Council, Vegreville, AB

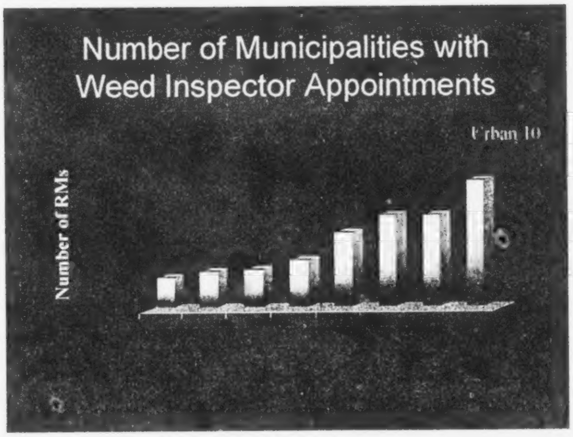
Clark Brenzil, Weed Control Specialist,
SAFRR, Regina, SK

Funded by TAD (Technology Adoption and Demonstration Fund)

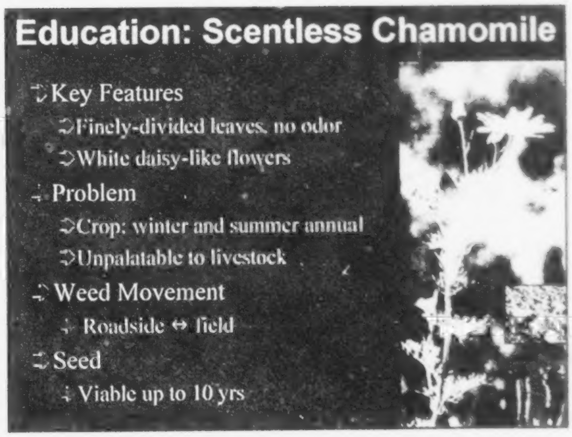


Good Business Practices

- Municipalities should appoint a Weed Inspector (WI)
  - WI Enforces *The Noxious Weed Act, 1984*
  - Trucking hay and straw
- Rural and Urban Appointments
- Everyone should look for noxious weeds
- Pesticide Applicator License (SIAST)
  - Industrial Vegetation: $160 + $40 (Books)
  - Renew every 5 yrs: $40 + $40 (Books)

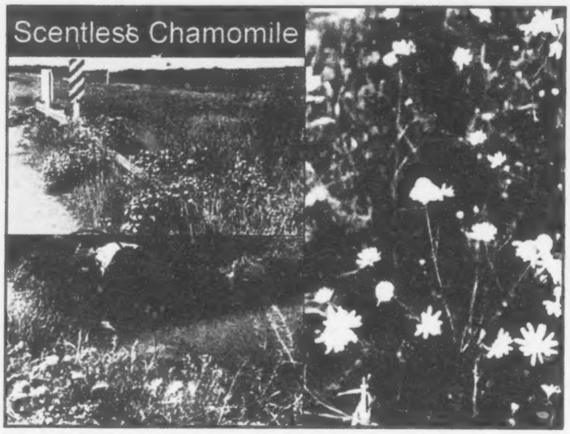


Number of Municipalities with Weed Inspector Appointments

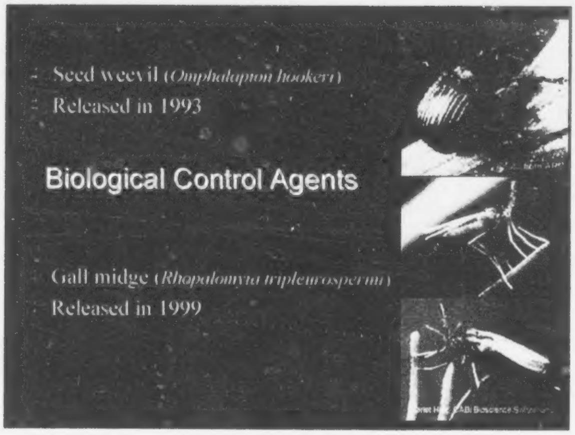


Education: Scentless Chamomile

- Key Features
  - Finely-divided leaves, no odor
  - White daisy-like flowers
- Problem
  - Crop: winter and summer annual
  - Unpalatable to livestock
- Weed Movement
  - Roadside ↔ field
- Seed
  - Viable up to 10 yrs



Scentless Chamomile

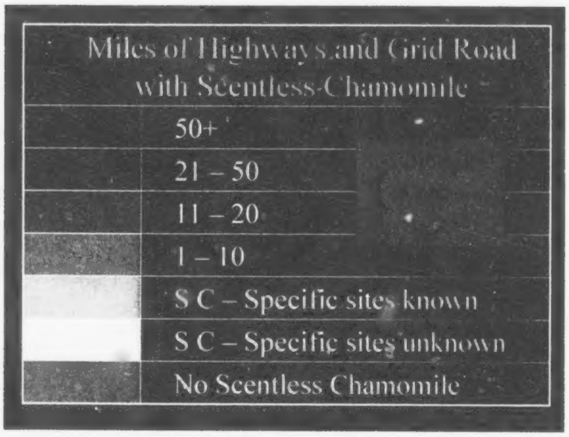


Seed weevil (*Omphalapion hookeri*)
Released in 1993

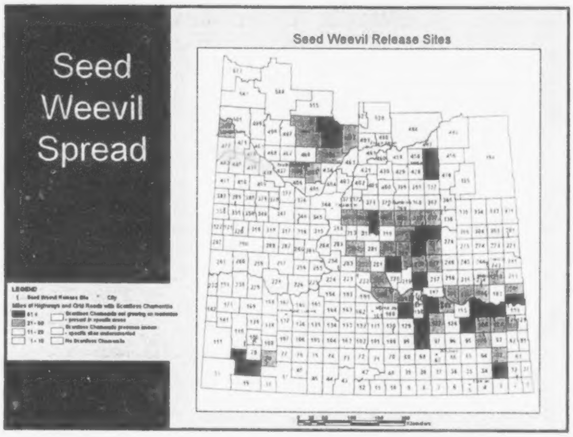
Biological Control Agents

Gall midge (*Rhopalomyia tripleurospermi*)
Released in 1999

[illegible] CABI Bioscience Switzerland

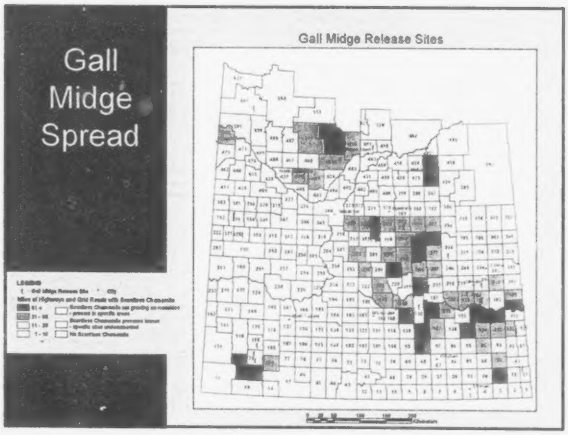


Miles of Highways and Grid Road with Scentless-Chamomile	
	50+
	21 – 50
	11 – 20
	1 – 10
	S C – Specific sites known
	S C – Specific sites unknown
	No Scentless Chamomile



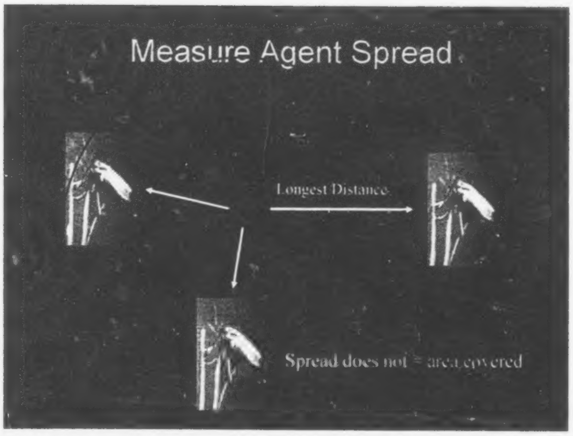
Seed Weevil Spread

Seed Weevil Release Sites



Gall Midge Spread

Gall Midge Release Sites

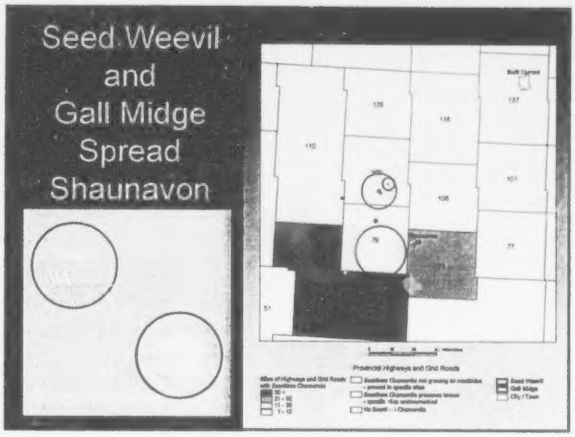


Measure Agent Spread

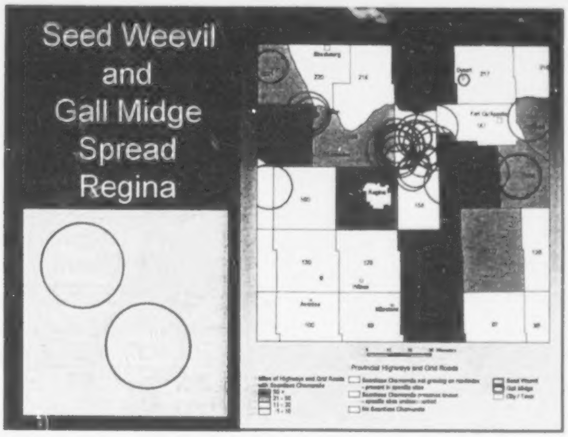
Longest Distance

Spread does not = area covered

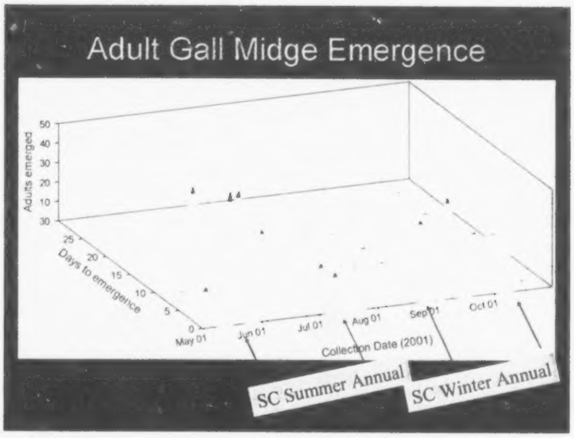
Appendix 4 Page 2



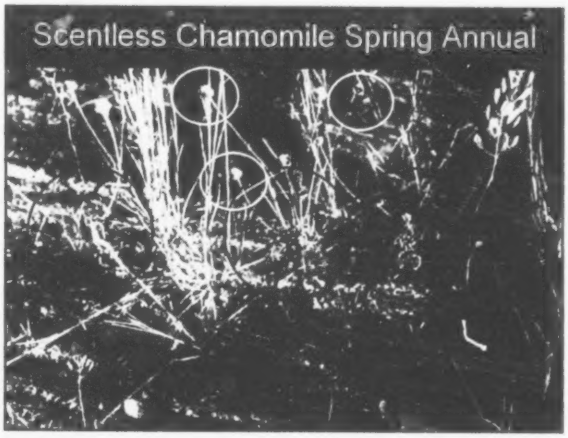
Seed Weevil
and
Gall Midge
Spread
Shaunavon



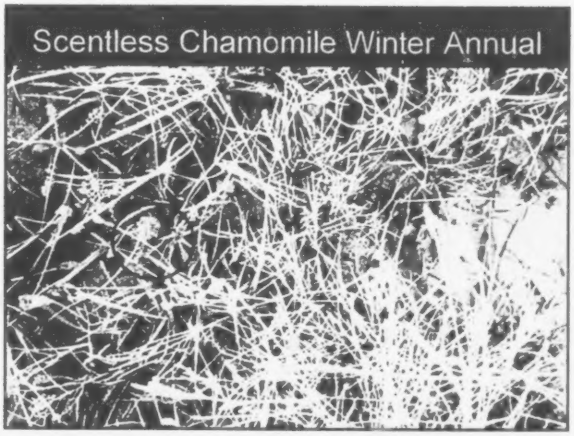
Seed Weevil
and
Gall Midge
Spread
Regina



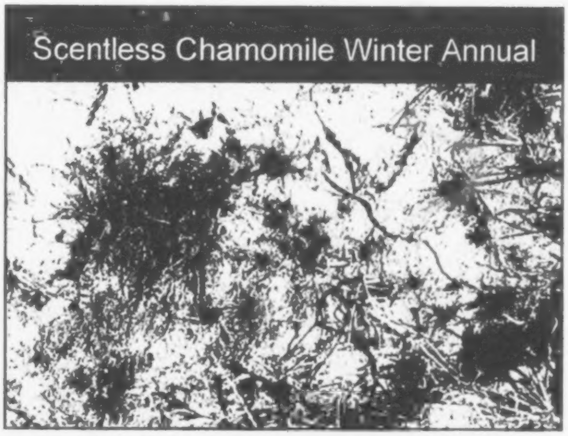
Adult Gall Midge Emergence



Scentless Chamomile Spring Annual

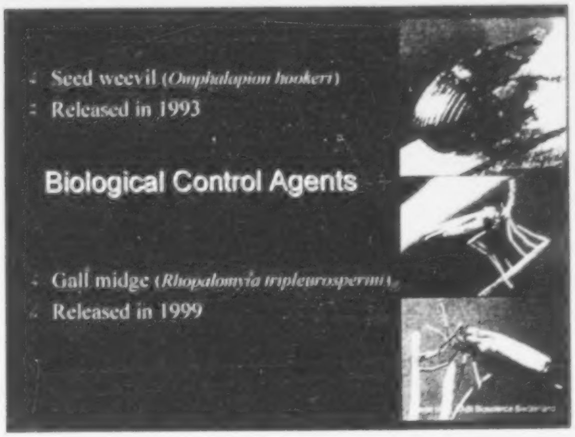


Scentless Chamomile Winter Annual



Scentless Chamomile Winter Annual

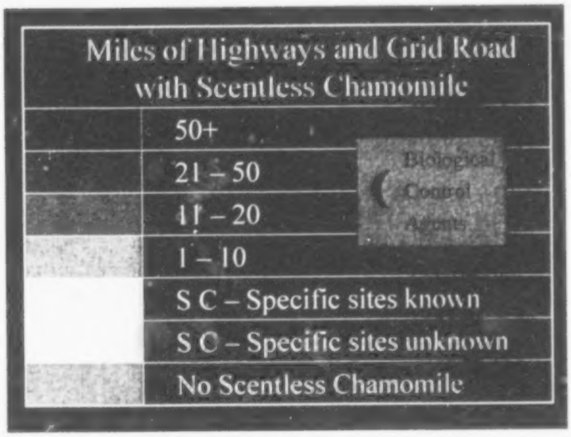
Scentless Chamomile



- Seed weevil (*Omphalapion hookeri*)
- Released in 1993

Biological Control Agents

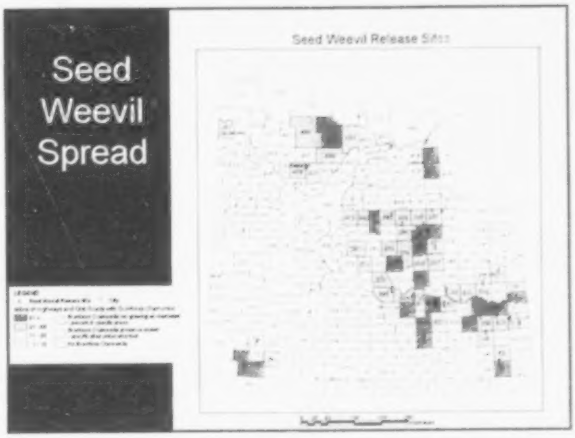
- Gall midge (*Rhopalomyia tripleurospermi*)
- Released in 1999



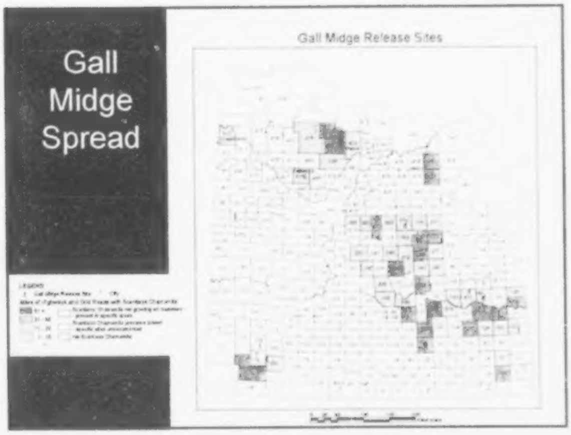
Miles of Highways and Grid Road with Scentless Chamomile

■	50+
■	21 – 50
▨	11 – 20
░	1 – 10
□	S C – Specific sites known
□	S C – Specific sites unknown
░	No Scentless Chamomile

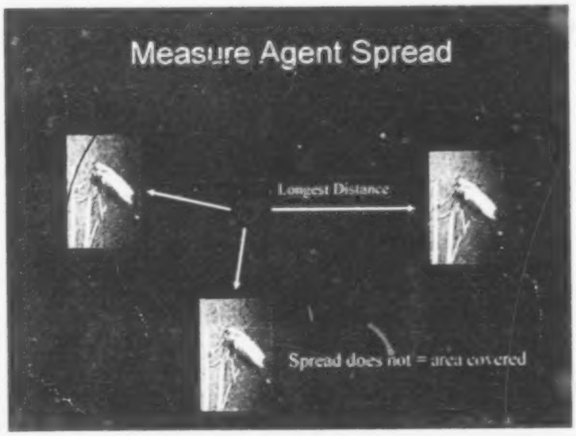
Biological Control Agents



Seed Weevil Spread

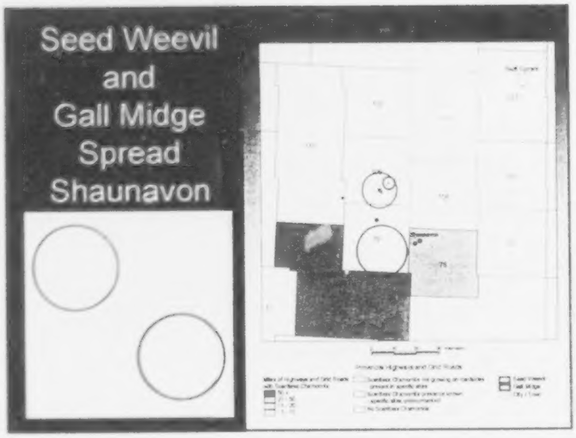


Gall Midge Spread

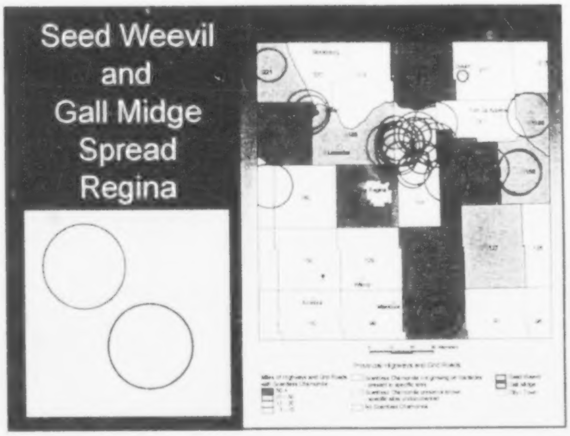


Measure Agent Spread

Spread does not = area covered



Seed Weevil
and
Gall Midge
Spread
Shaunavon



Seed Weevil
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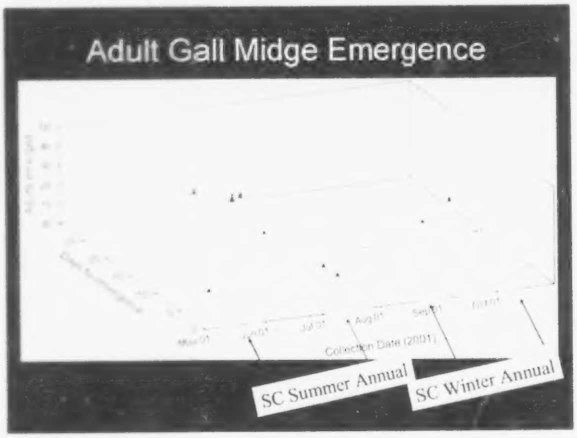
Regina



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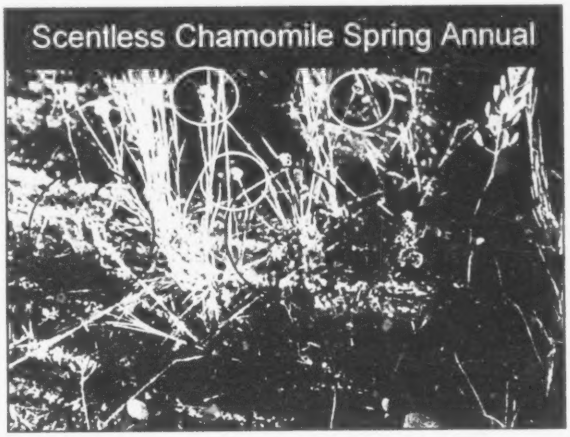
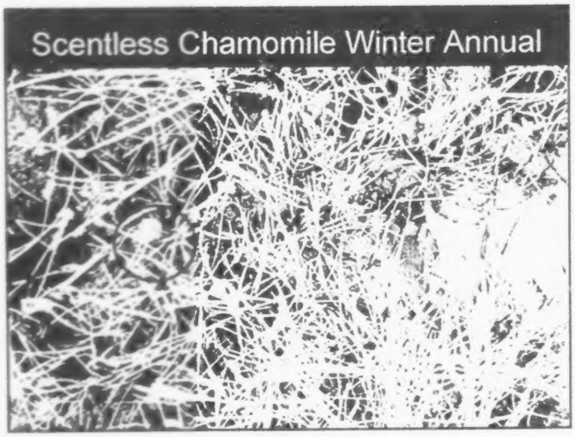
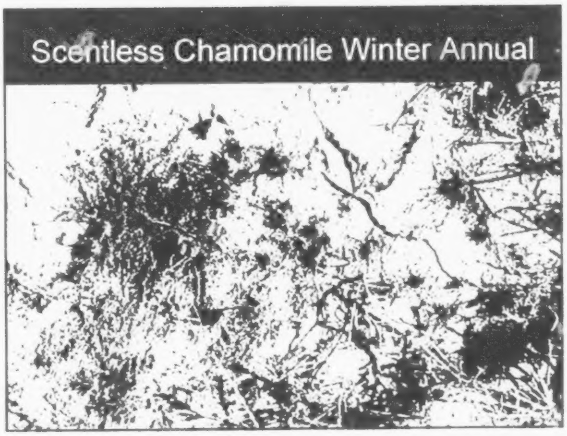


Scentless Chamomile Spring Annual



Scentless Chamomile Winter Annual

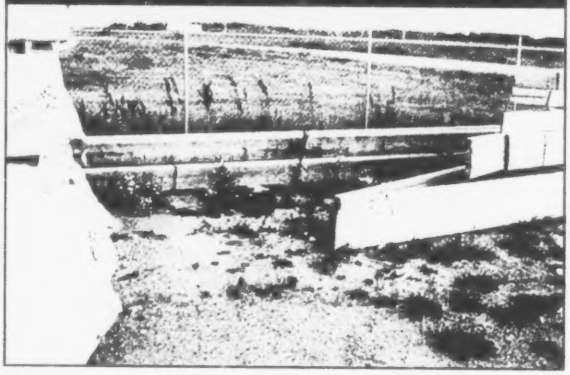


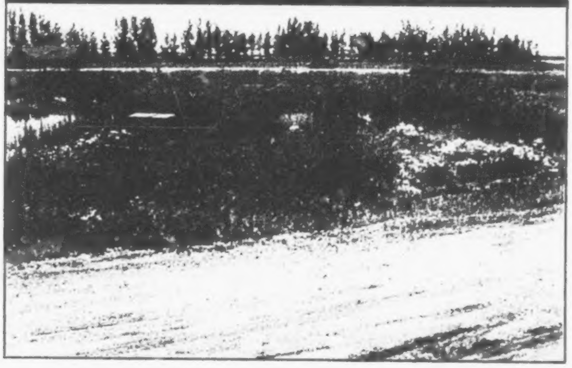
Scentless Chamomile Winter Annual

Grasshoppers & Scentless Chamomile

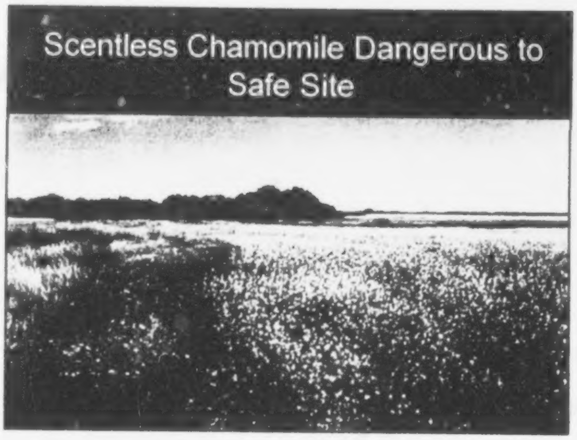
Scentless Chamomile Safe Site

Scentless Chamomile Safe Site

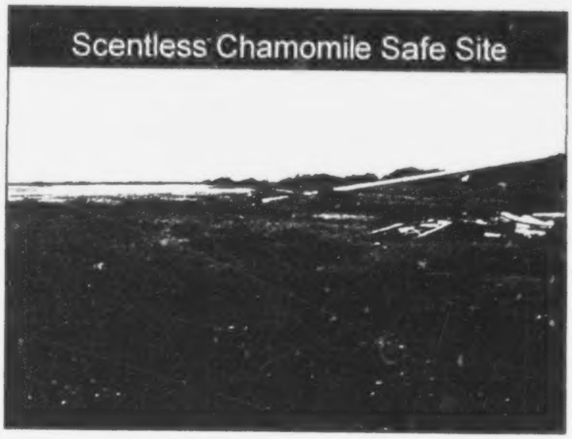

Scentless Chamomile Safe Site


Scentless Chamomile Safe Site

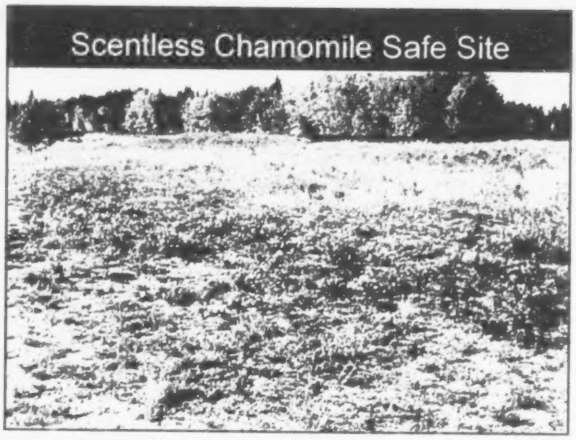
Scentless Chamomile Safe Site



Scentless Chamomile Dangerous to Safe Site



Scentless Chamomile Safe Site



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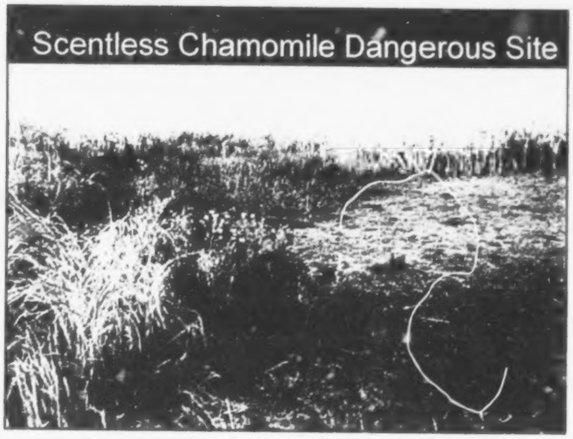
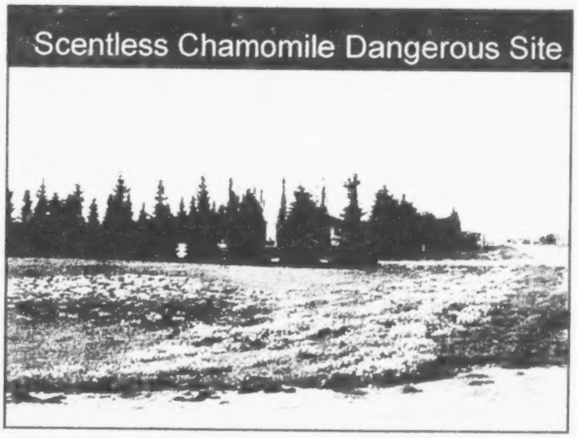
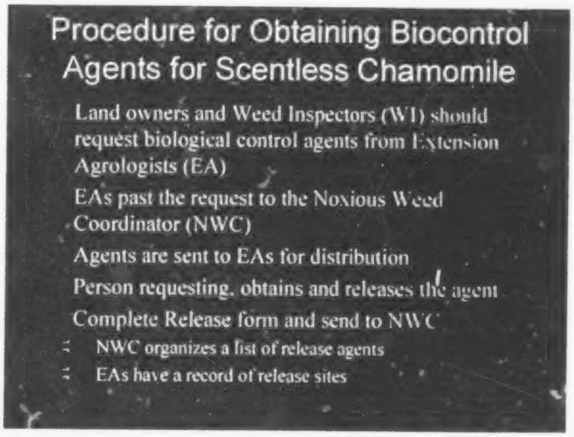


Scentless Chamomile Dangerous Site

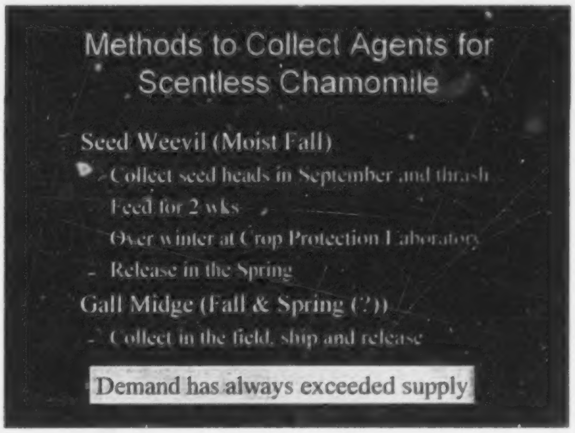


Scentless Chamomile Dangerous Site



Procedure for Obtaining Biocontrol Agents for Scentless Chamomile

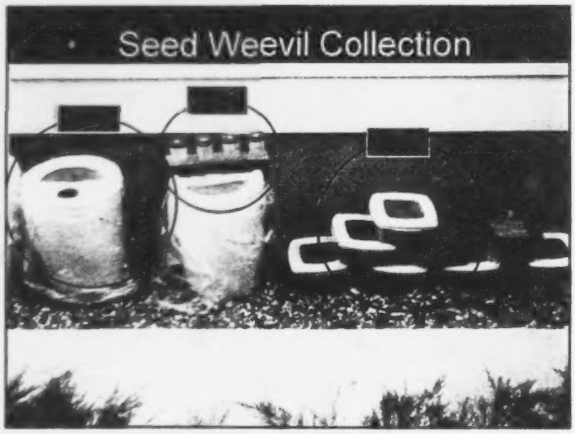
- Land owners and Weed Inspectors (WI) should request biological control agents from Extension Agrologists (EA)
- EAs past the request to the Noxious Weed Coordinator (NWC)
- Agents are sent to EAs for distribution
- Person requesting, obtains and releases the agent
- Complete Release form and send to NWC
  - NWC organizes a list of release agents
  - EAs have a record of release sites



Methods to Collect Agents for Scentless Chamomile

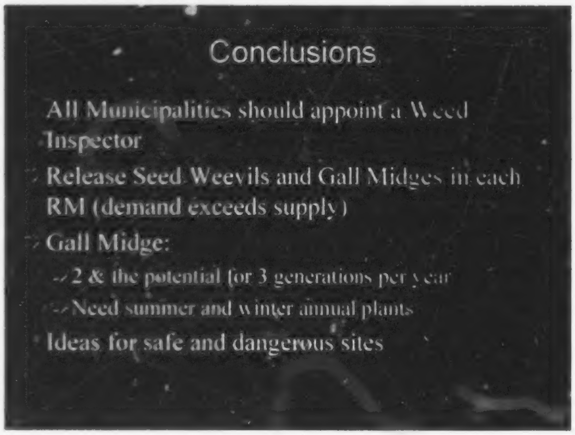
- Seed Weevil (Moist Fall)
  - Collect seed heads in September and thrash
  - Feed for 2 wks
  - Over winter at Crop Protection Laboratory
  - Release in the Spring
- Gall Midge (Fall & Spring (?))
  - Collect in the field, ship and release

Demand has always exceeded supply



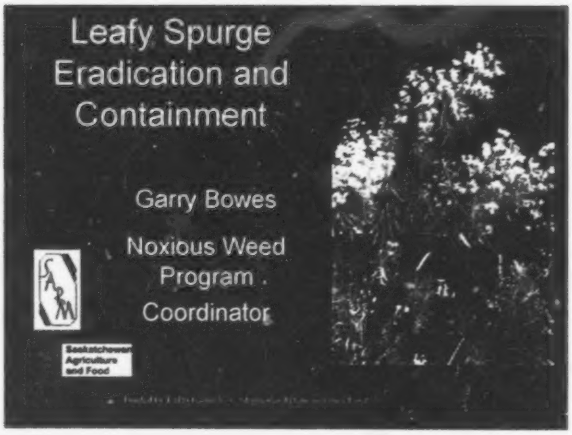
Seed Weevil Collection

Collect Scentless Chamomile in the Fall



Conclusions

- All Municipalities should appoint a Weed Inspector
- Release Seed Weevils and Gall Midges in each RM (demand exceeds supply)
- Gall Midge:
  - 2 & the potential for 3 generations per year
  - Need summer and winter annual plants
- Ideas for safe and dangerous sites

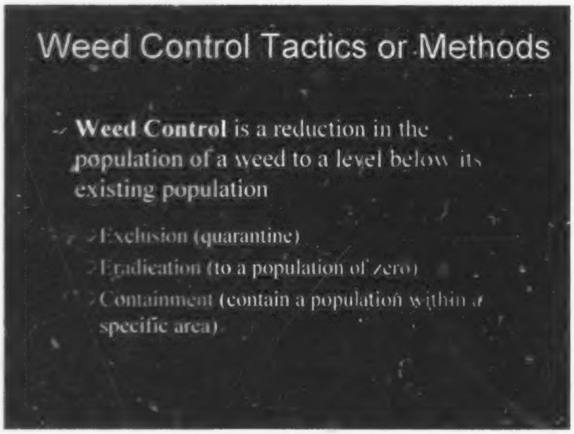


Leafy Spurge Eradication and Containment

Garry Bowes

Noxious Weed Program Coordinator

Saskatchewan Agriculture and Food



Weed Control Tactics or Methods

- **Weed Control** is a reduction in the population of a weed to a level below its existing population
  - Exclusion (quarantine)
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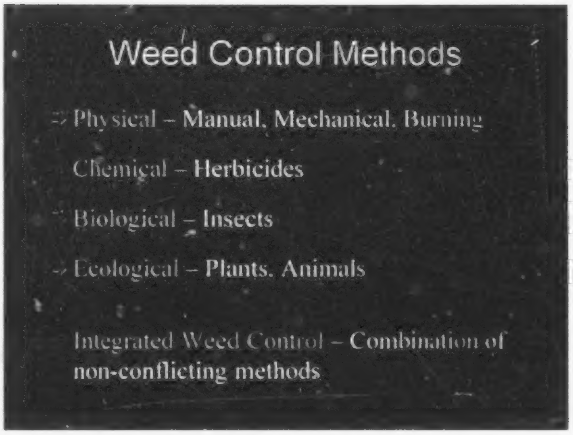
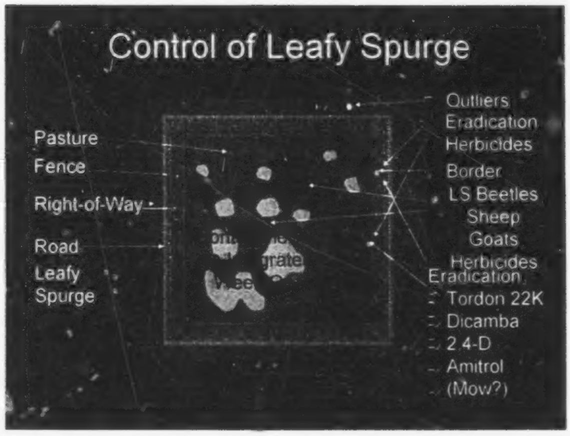


Weed Control Methods

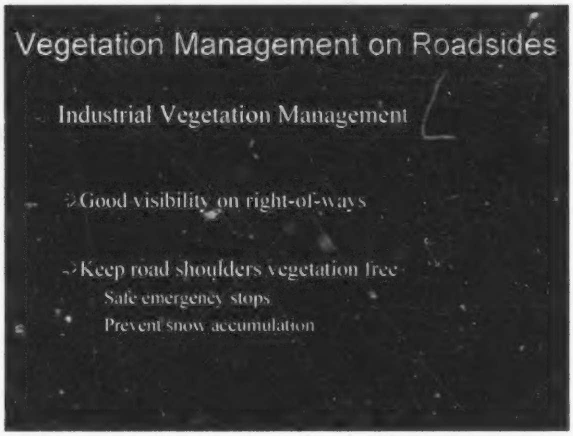
- Physical – **Manual, Mechanical, Burning**
- Chemical – **Herbicides**
- Biological – **Insects**
- Ecological – **Plants, Animals**

Integrated Weed Control – **Combination of non-conflicting methods**



Control of Leafy Spurge

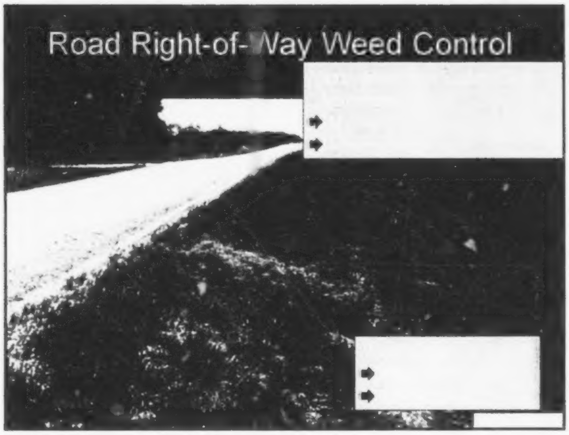
- Tordon 22K
- Dicamba
- 2,4-D
- Amitrol
- (Mow?)



Vegetation Management on Roadsides

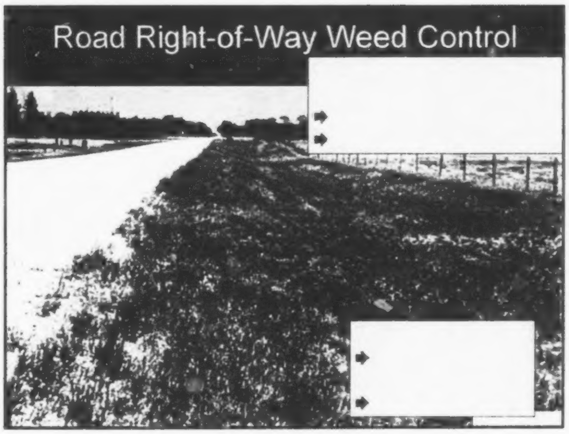
Industrial Vegetation Management

- Good visibility on right-of-ways
- Keep road shoulders vegetation free
  - Safe emergency stops
  - Prevent snow accumulation



Road Right-of-Way Weed Control

This is when Leafy Spurge should be found



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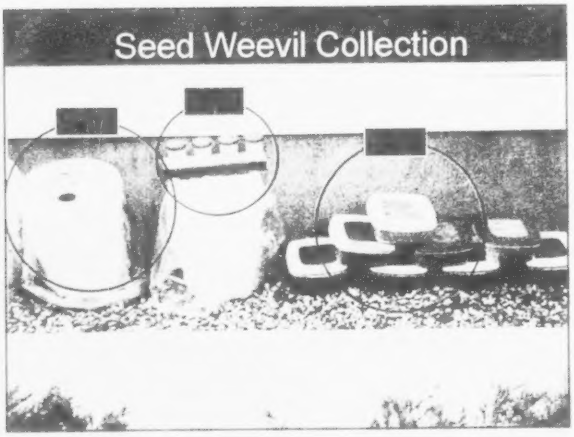

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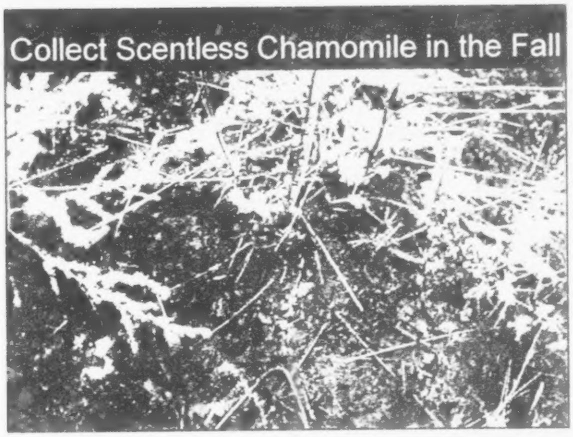

Collect Scentless Chamomile in the Fall

Conclusions

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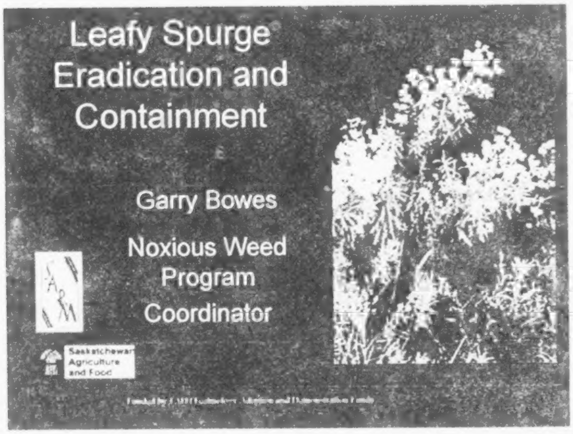

Leafy Spurge Eradication and Containment

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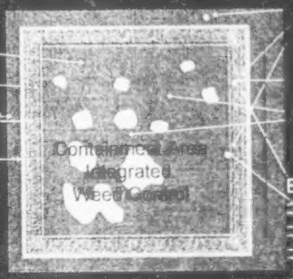
[illegible] et al 1987

Control of Leafy Spurge



Pasture
Fence
Right-of-Way
Road
Leafy Spurge

Outliers
Eradication
Herbicides

Border
LS Beetles
Sheep
Goats
Herbicides

Eradication
- ⇒ Tordon 22K
- ⇒ Dicamba
- ⇒ 2,4-D
- ⇒ Amitrol
- ⇒ (Mow?)

Vegetation Management on Roadsides

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  - ⇒ Keep road shoulders vegetation free
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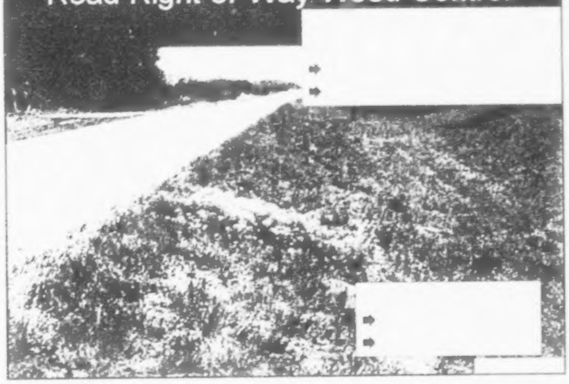
Road Right-of-Way Weed Control



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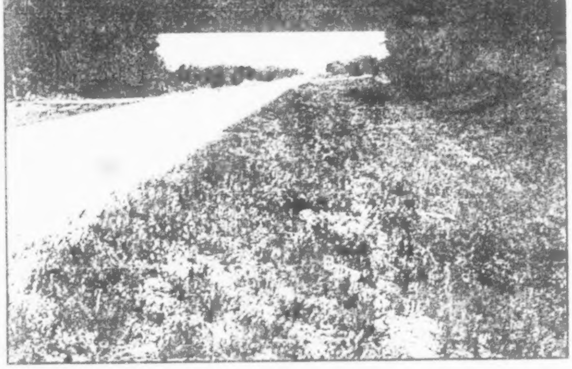
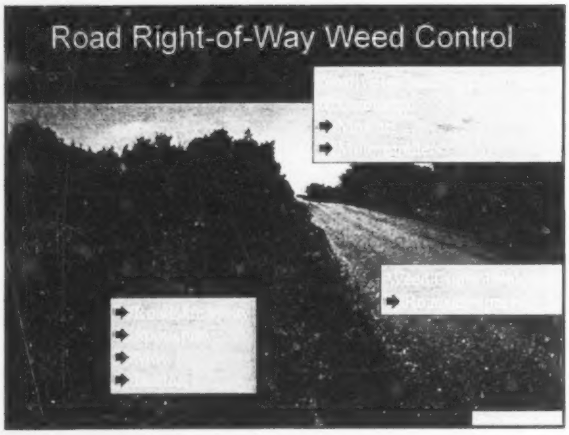


Road Right-of-Way Weed Control



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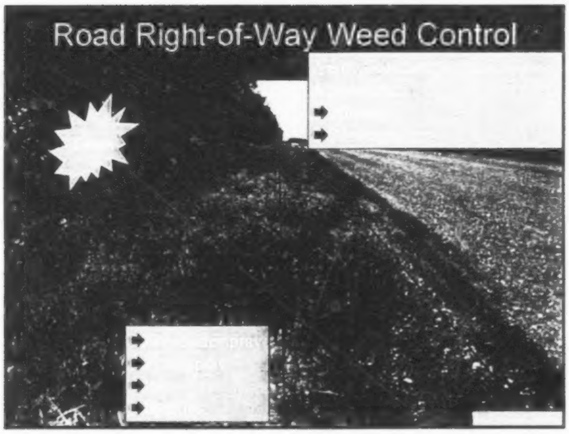
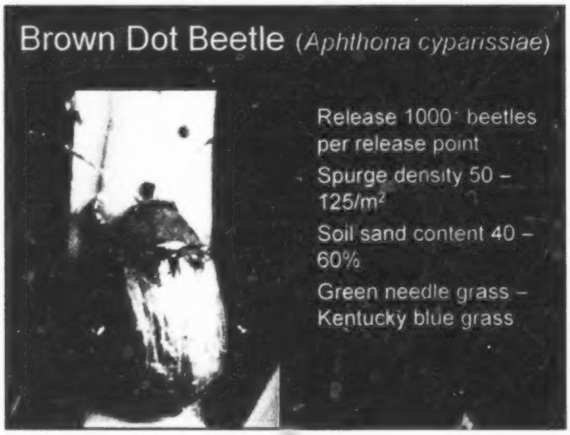


Road Right-of-Way Weed Control

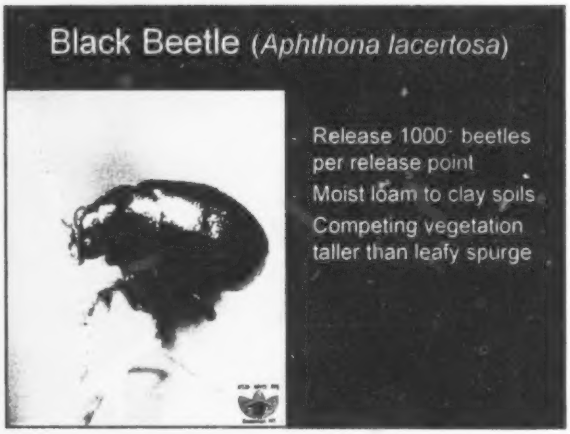
Black Dot Beetle (*Aphthona nigriscutis*)

- Release 1000⁺ beetles per release point
- Coarse dry to very dry soils
- Soil warmed by aspect or lack ground cover
- Spurge density <60/m²



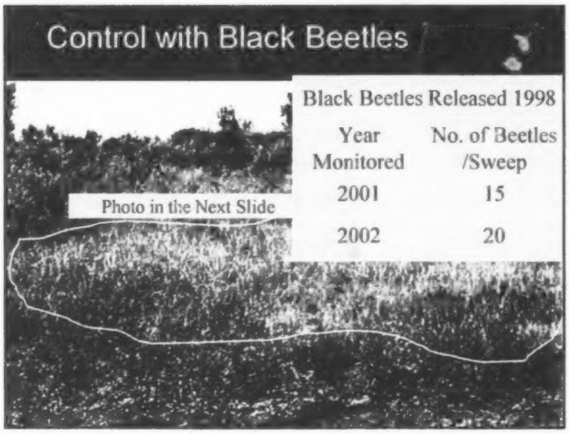
Brown Dot Beetle (*Aphthona cyparissiae*)

- Release 1000⁺ beetles per release point
- Spurge density 50 – 125/m²
- Soil sand content 40 – 60%
- Green needle grass – Kentucky blue grass



Black Beetle (*Aphthona lacertosa*)

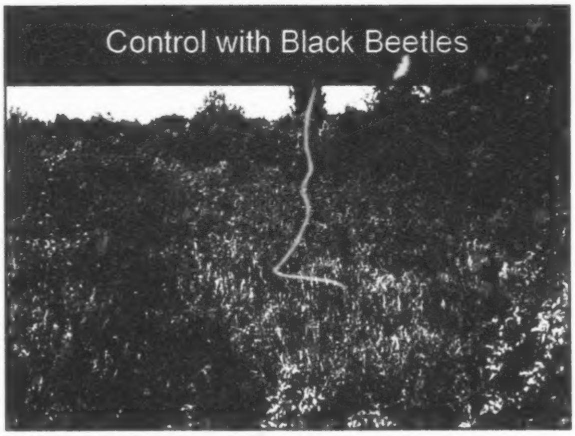
- Release 1000⁺ beetles per release point
- Moist loam to clay soils
- Competing vegetation taller than leafy spurge



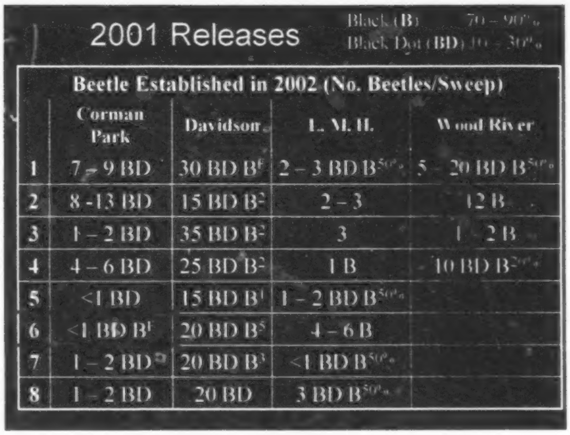
Control with Black Beetles

Black Beetles Released 1998

Year Monitored	No. of Beetles /Sweep
2001	15
2002	20



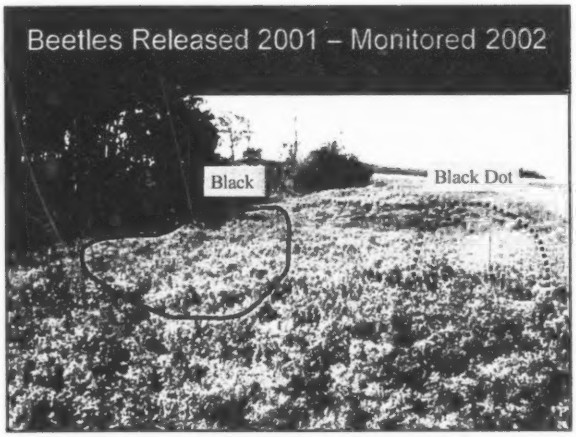
Control with Black Beetles



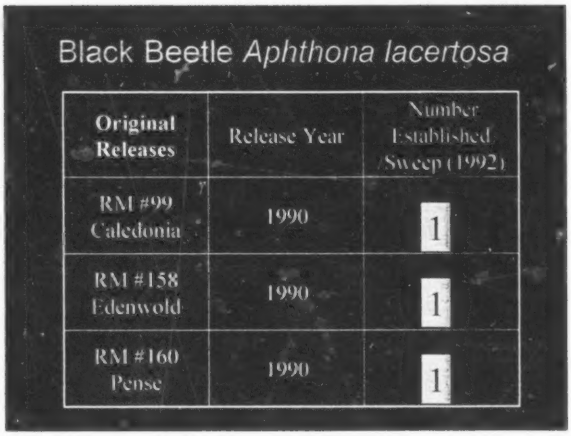
2001 Releases

Black (B) 70 – 90%
Black Dot (BD) 10 – 30%

Beetle Established in 2002 (No. Beetles/Sweep)				
	Corman Park	Davidson	L. M. H.	Wood River
1	7 – 9 BD	30 BD B^{f}	2 – 3 BD $B^{50\%}$	5 – 20 BD $B^{50\%}$
2	8 -13 BD	15 BD B^{2}	2 – 3	12 B
3	1 – 2 BD	35 BD B^{2}	3	1 – 2 B
4	4 – 6 BD	25 BD B^{2}	1 B	10 BD $B^{20\%}$
5	<1 BD	15 BD B^{1}	1 – 2 BD $B^{50\%}$	
6	<1 BD B^{f}	20 BD B^{5}	4 – 6 B	
7	1 – 2 BD	20 BD B^{3}	<1 BD $B^{50\%}$	
8	1 – 2 BD	20 BD	3 BD $B^{50\%}$	

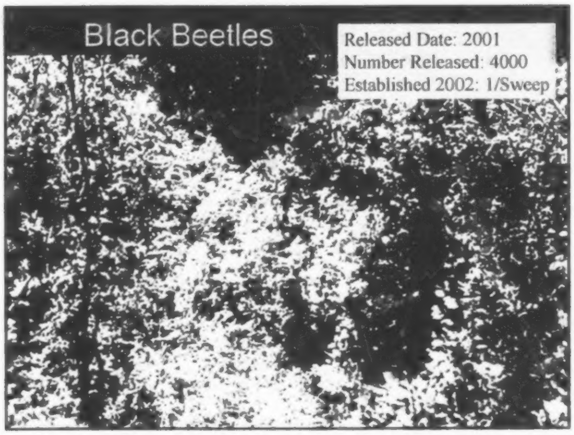


Beetles Released 2001 – Monitored 2002



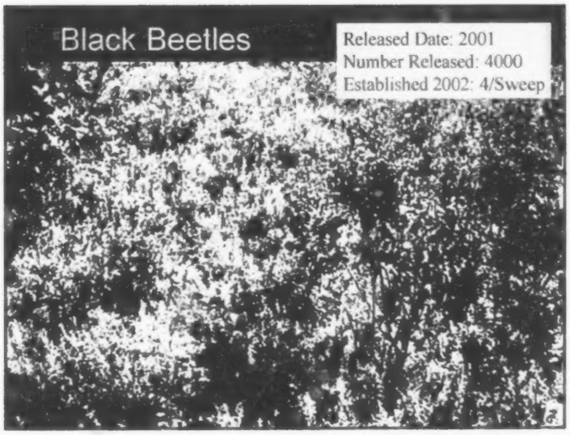
Black Beetle *Aphthona lacertosa*

Original Releases	Release Year	Number Established /Sweep (1992)
RM #99 Caledonia	1990	1
RM #158 Edenwold	1990	1
RM #160 Pense	1990	1



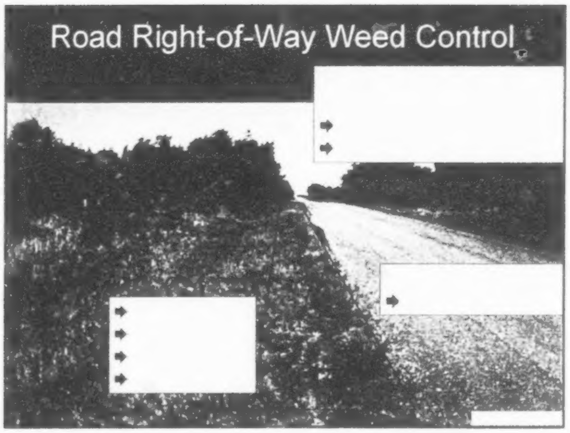
Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 1/Sweep

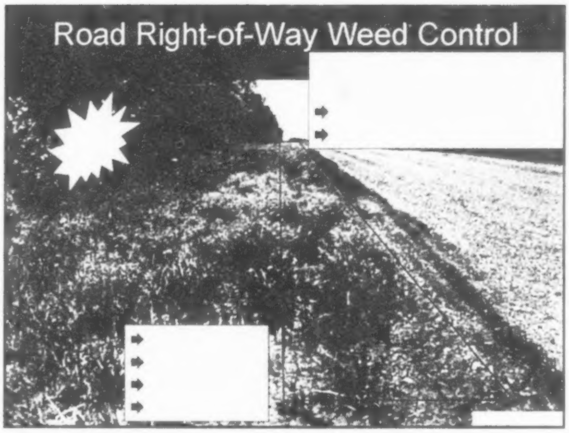


Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 4/Sweep



Road Right-of-Way Weed Control



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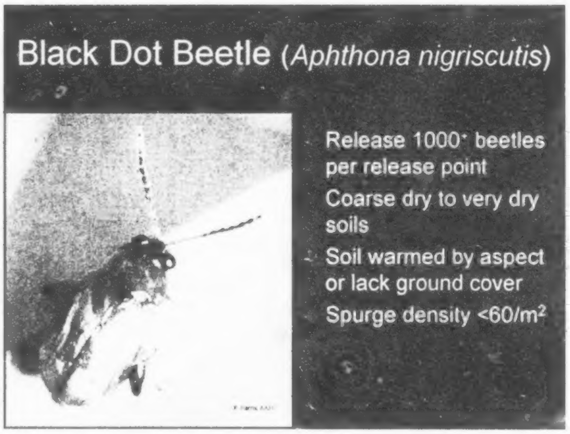

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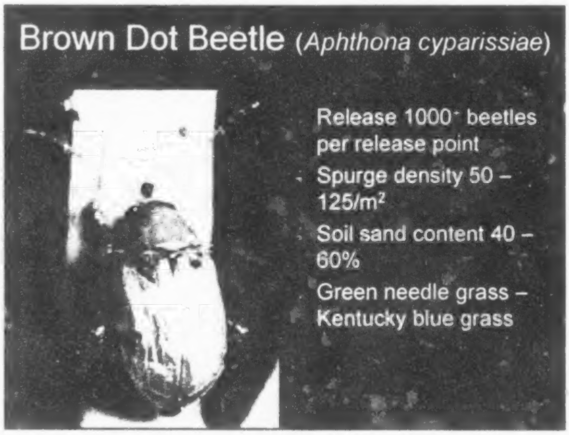
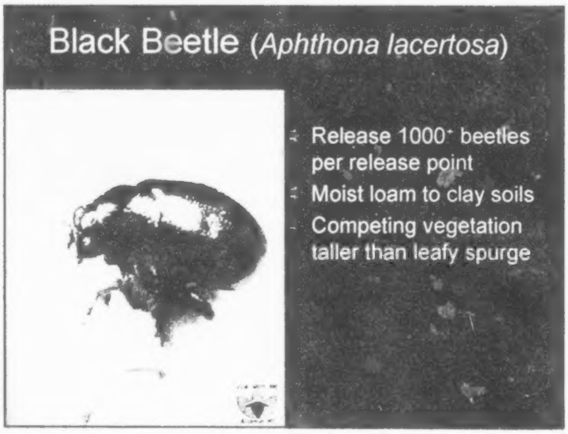
- Soil warmed by aspect or lack ground cover
- Spurge density $<60/m^2$



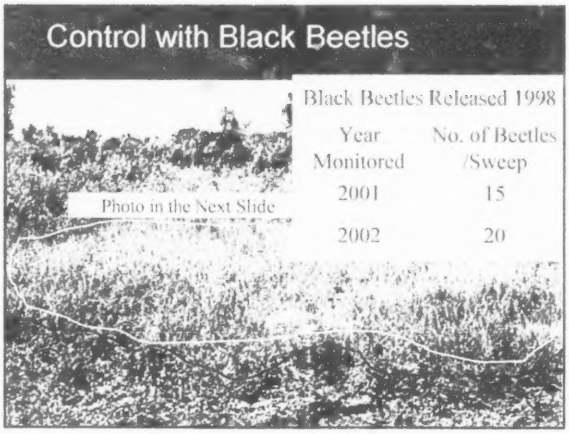
Brown Dot Beetle (*Aphthona cyparissiae*)

- Release 1000^+ beetles per release point
- Spurge density 50 – $125/m^2$
- Soil sand content 40 – 60%
- Green needle grass – Kentucky blue grass



Black Beetle (*Aphthona lacertosa*)

- Release 1000^+ beetles per release point
- Moist loam to clay soils
- Competing vegetation taller than leafy spurge

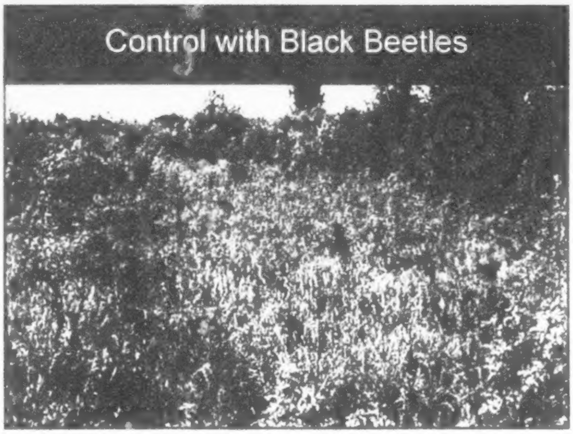


Control with Black Beetles

Black Beetles Released 1998

Year Monitored	No. of Beetles /Sweep
2001	15
2002	20

Photo in the Next Slide



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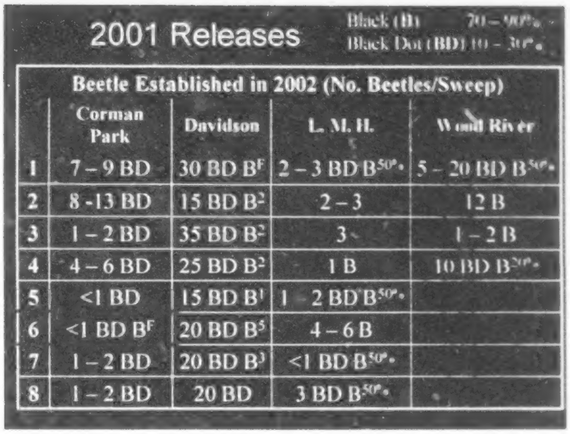
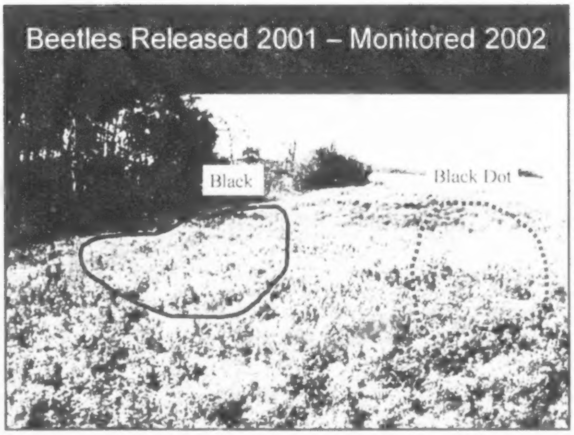


2001 Releases

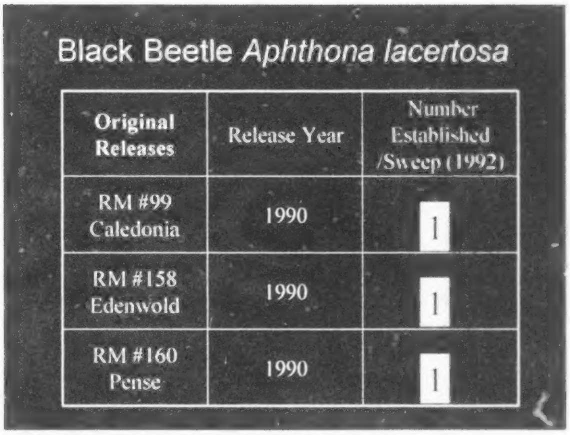
Black (B) 70 – 90%

Black Dot (BD) 10 – 30%

Beetle Established in 2002 (No. Beetles/Sweep)				
	Corman Park	Davidson	L. M. H.	Wood River
1	7 – 9 BD	30 BD B^{F}	2 – 3 BD B$^{50\%}$	5 – 20 BD B$^{50\%}$
2	8 -13 BD	15 BD B^{2}	2 – 3	12 B
3	1 – 2 BD	35 BD B^{2}	3	1 – 2 B
4	4 – 6 BD	25 BD B^{2}	1 B	10 BD B$^{20\%}$
5	<1 BD	15 BD B^{1}	1 – 2 BD B$^{50\%}$	
6	<1 BD B^{F}	20 BD B^{5}	4 – 6 B	
7	1 – 2 BD	20 BD B^{3}	<1 BD B$^{50\%}$	
8	1 – 2 BD	20 BD	3 BD B$^{50\%}$	

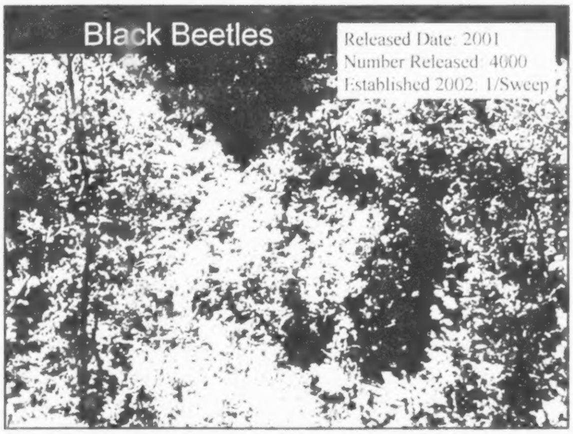


Beetles Released 2001 – Monitored 2002



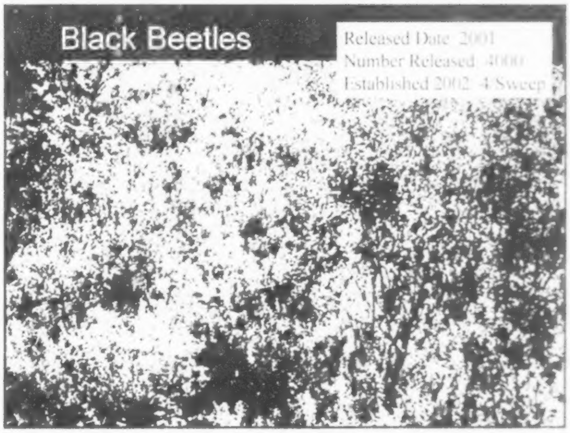
Black Beetle *Aphthona lacertosa*

Original Releases	Release Year	Number Established /Sweep (1992)
RM #99 Caledonia	1990	1
RM #158 Edenwold	1990	1
RM #160 Pense	1990	1



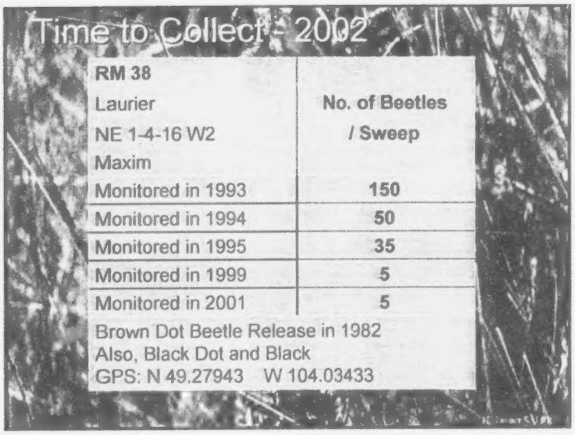
Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 1/Sweep



Black Beetles

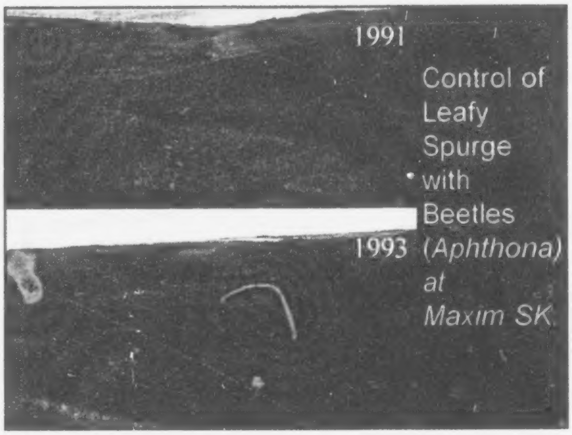
Released Date: 2001
Number Released: 4000
Established 2002: 4/Sweep



Time to Collect - 2002

RM 38 Laurier NE 1-4-16 W2 Maxim	No. of Beetles / Sweep
Monitored in 1993	150
Monitored in 1994	50
Monitored in 1995	35
Monitored in 1999	5
Monitored in 2001	5

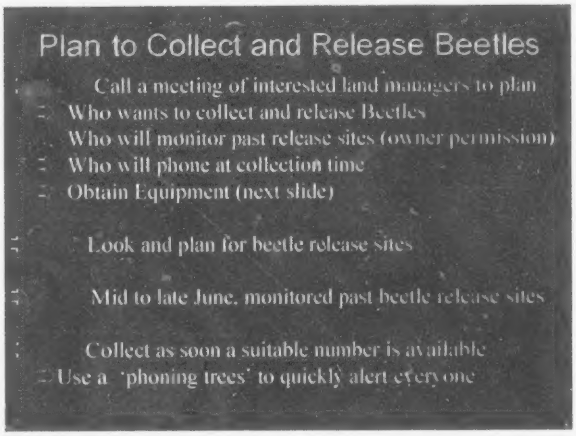
Brown Dot Beetle Release in 1982
Also, Black Dot and Black
GPS: N 49.27943 W 104.03433



1991

1993

Control of Leafy Spurge with Beetles (*Aphthona*) at *Maxim SK*



Plan to Collect and Release Beetles

- Call a meeting of interested land managers to plan
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  - Obtain Equipment (next slide)
- Look and plan for beetle release sites
- Mid to late June, monitored past beetle release sites
- Collect as soon a suitable number is available
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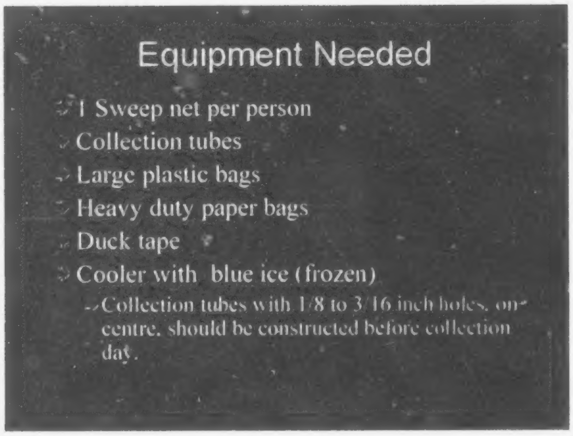
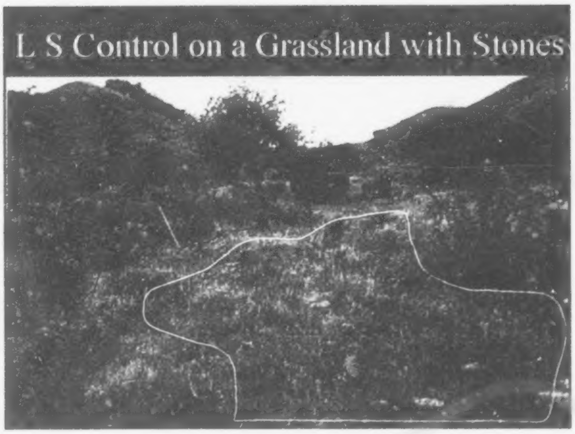
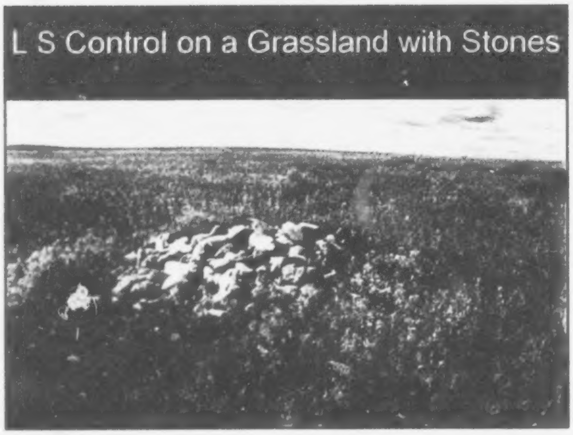


Equipment Needed

- 1 Sweep net per person
- Collection tubes
- Large plastic bags
- Heavy duty paper bags
- Duck tape
- Cooler with blue ice (frozen)
  - Collection tubes with 1/8 to 3/16 inch holes, on-centre, should be constructed before collection day.



L S Control on a Grassland with Stones



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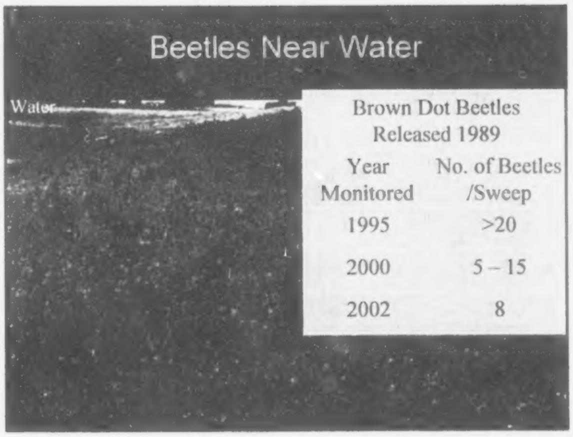

Beetles Near Water

Brown Dot Beetles
Released 1989

Year Monitored	No. of Beetles /Sweep
1995	>20
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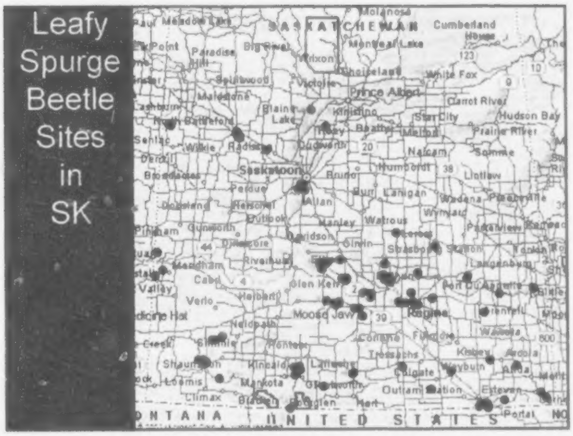
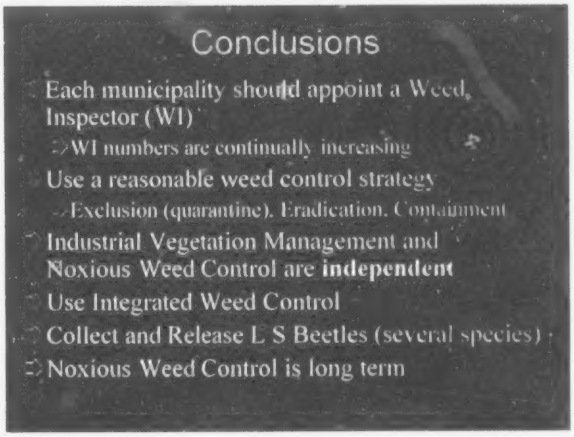
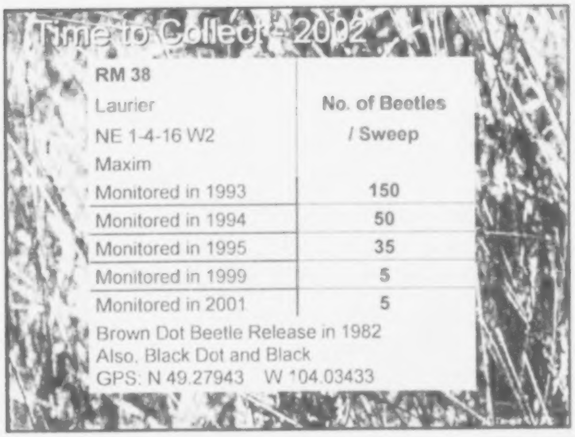


Leafy Spurge Beetle Sites in SK



Conclusions

- ⇨ Each municipality should appoint a Weed Inspector (WI)
  - ⇨ WI numbers are continually increasing
- ⇨ Use a reasonable weed control strategy
  - ⇨ Exclusion (quarantine). Eradication. Containment
- ⇨ Industrial Vegetation Management and Noxious Weed Control are **independent**
- ⇨ Use Integrated Weed Control
- ⇨ Collect and Release L S Beetles (several species)
- ⇨ Noxious Weed Control is long term



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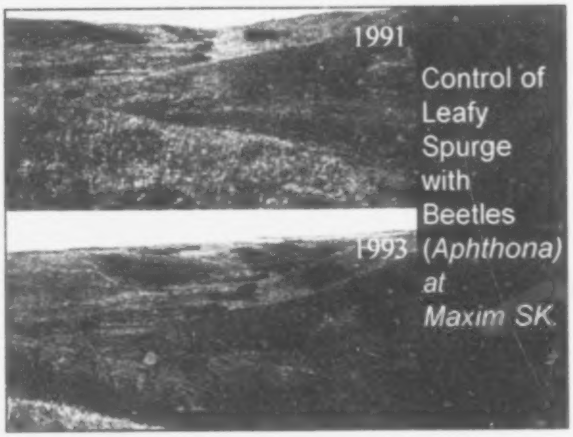

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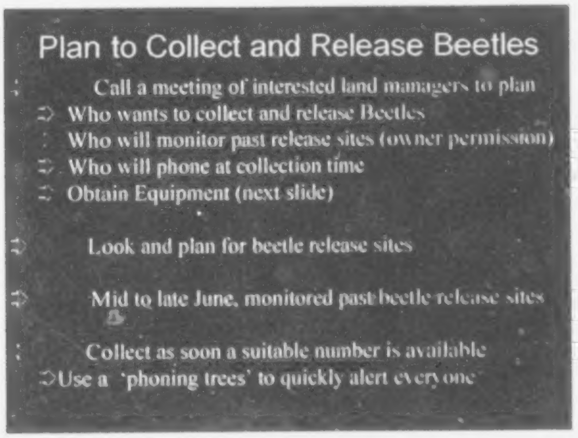

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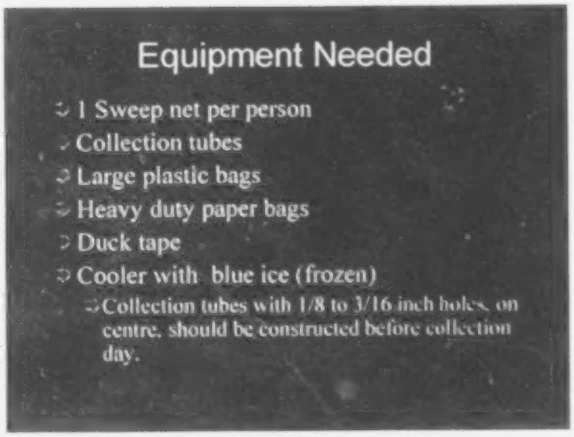

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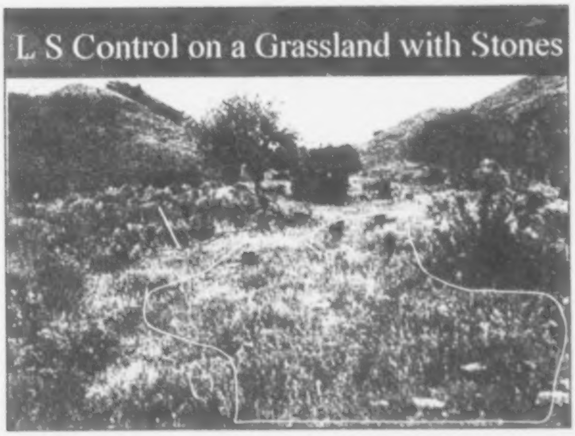

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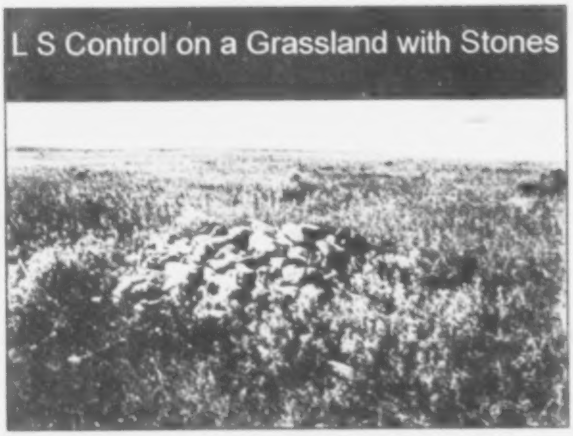

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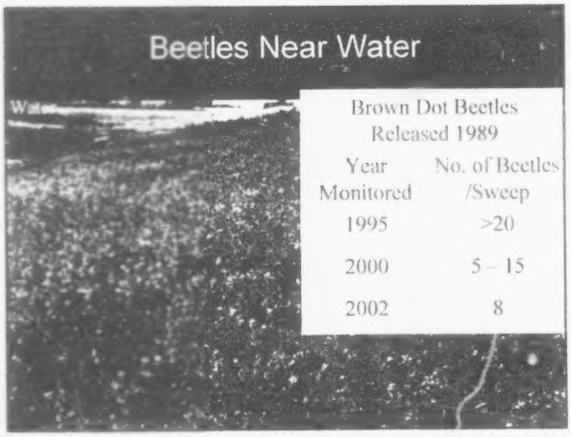

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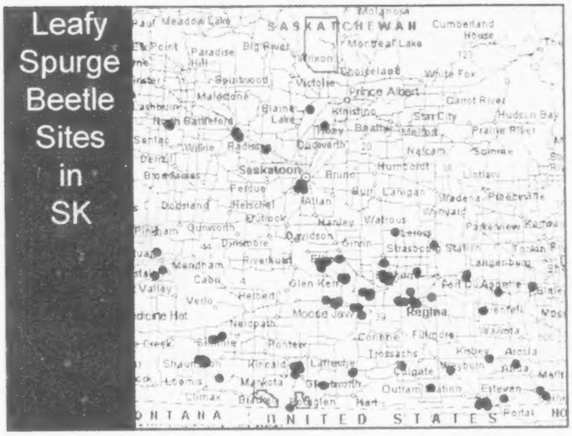

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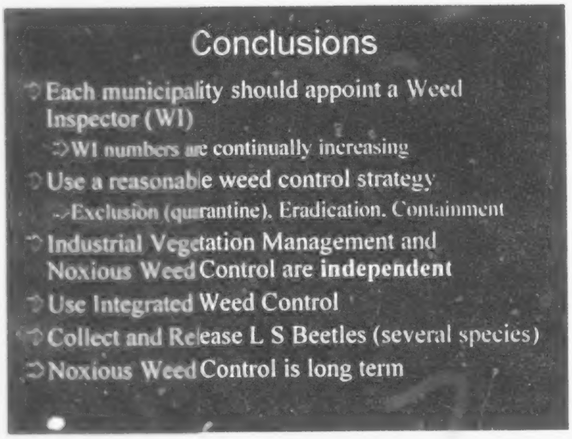

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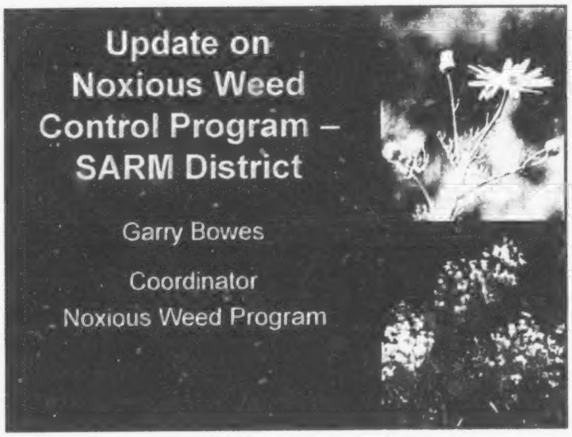


Update on Noxious Weed Control Program – SARM District

Garry Bowes

Coordinator
Noxious Weed Program

2003 Weed Inspector Training Clinics

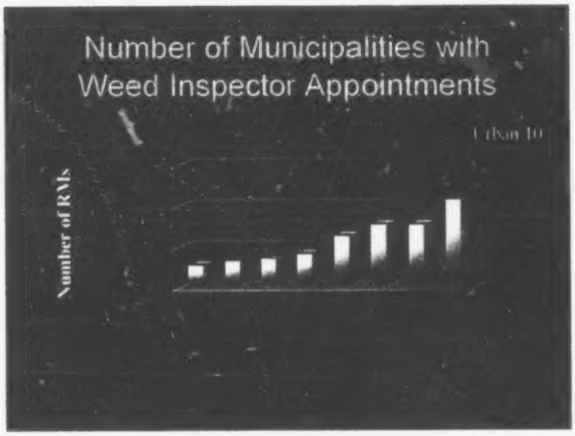
- The Spread of Scentless Chamomile Biological Control Agents (GB)
- Weed Management Strategies for Organic Producers (CB)
- Organic Crop Production and the Noxious Weed Act (TBA)
- Leafy Spurge Eradication and Containment (GB)
- Review of the Enforcement Process for the Noxious Weed Act (CB)

Time:
10:00 am
3:30 pm

Good Business Practices

- Municipalities should appoint a Weed Inspector (WI)
  - WI Enforces *The Noxious Weed Act, 1984*
  - Trucking hay and straw
- Rural and Urban Appointments
- Everyone should look for noxious weeds
- Pesticide Applicator License (SIAST)
  - Industrial Vegetation: $160 + $40 (Books)
  - Renew every 5 yrs: $40 + $40 (Books)

Number of Municipalities with Weed Inspector Appointments



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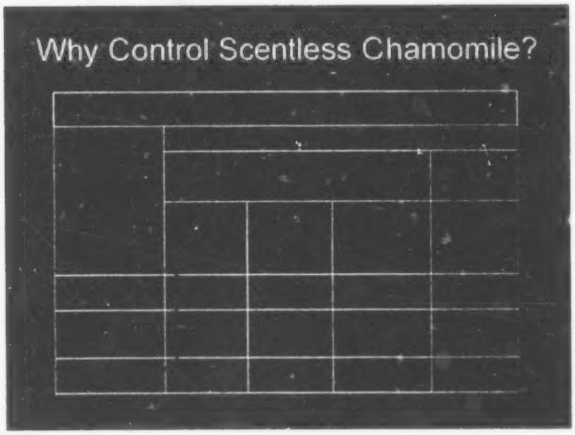
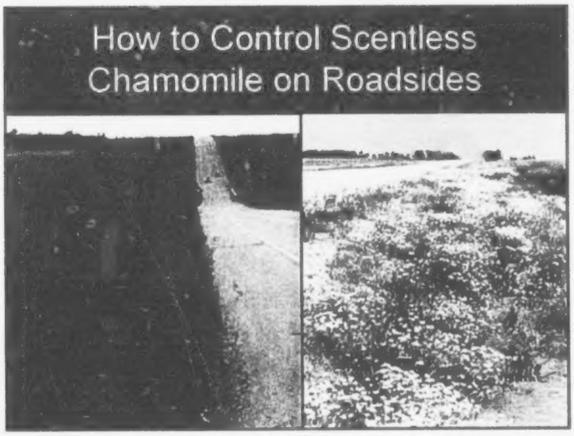
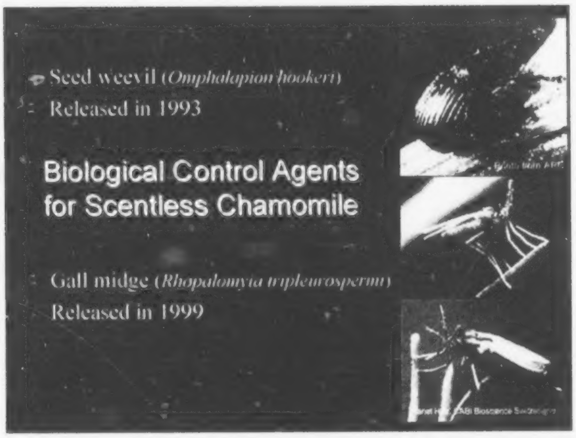
Why Control Scentless Chamomile?





How to Control Scentless Chamomile on Roadsides

Is Competition Perfect?



Biological Control Agents for Scentless Chamomile

- Seed weevil (*Omphalapion hookeri*)
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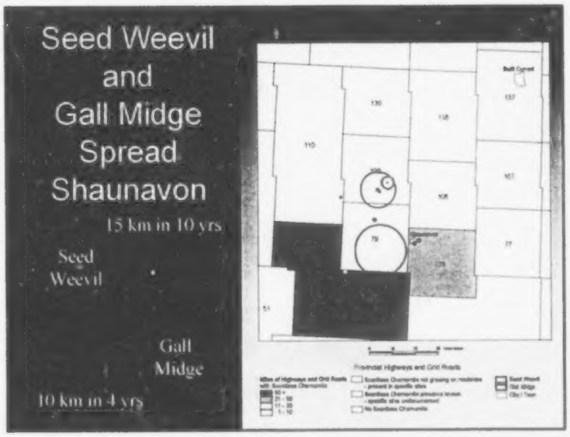

Seed Weevil and Gall Midge Spread Shaunavon

15 km in 10 yrs

Seed Weevil

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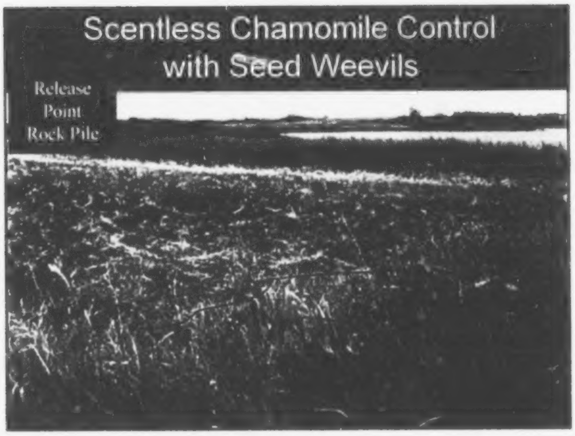
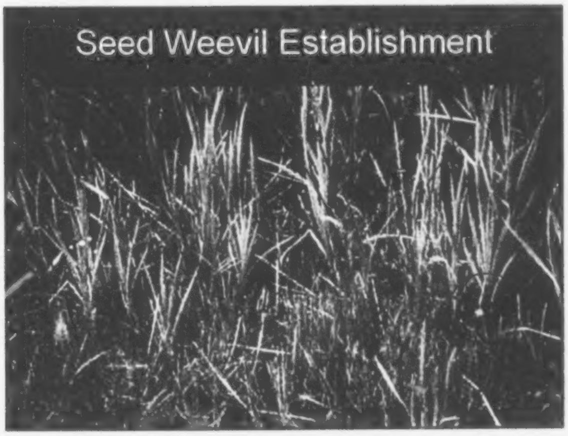
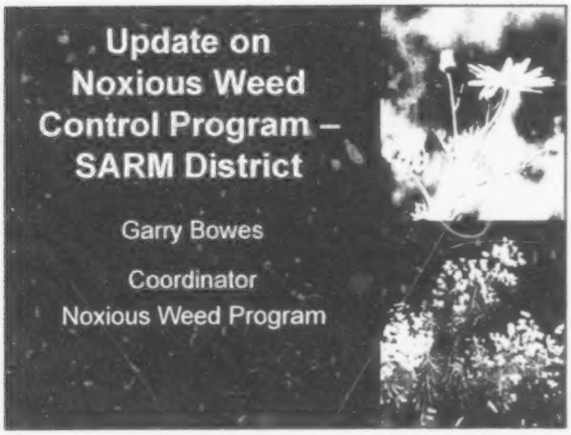


Scentless Chamomile Control with Seed Weevils

Release Point Rock Pile



Seed Weevil Establishment



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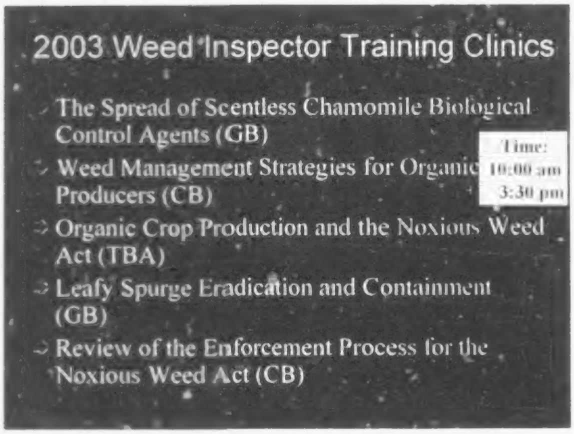

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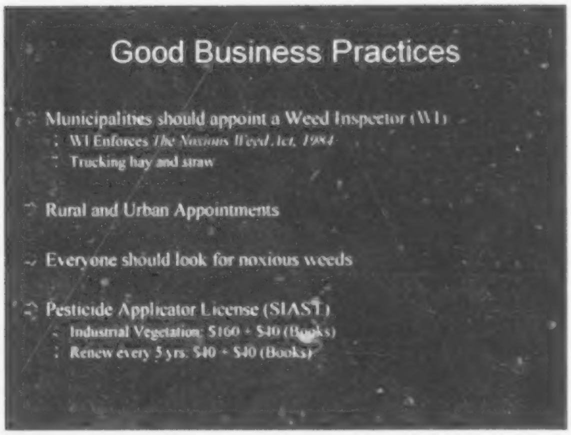

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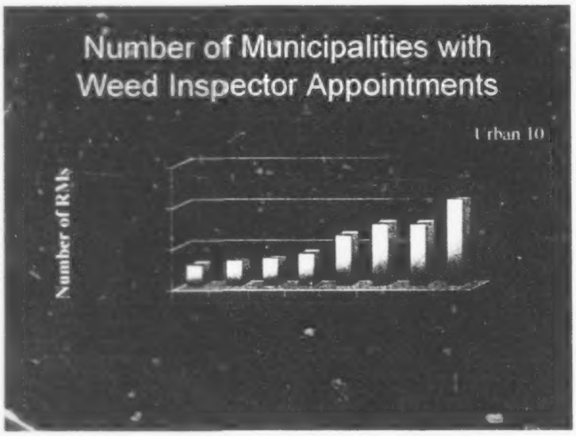

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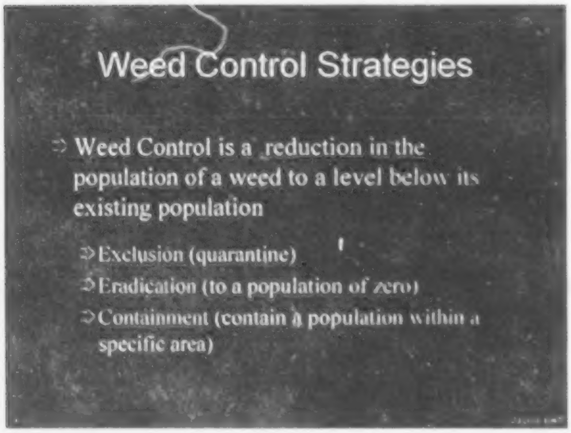

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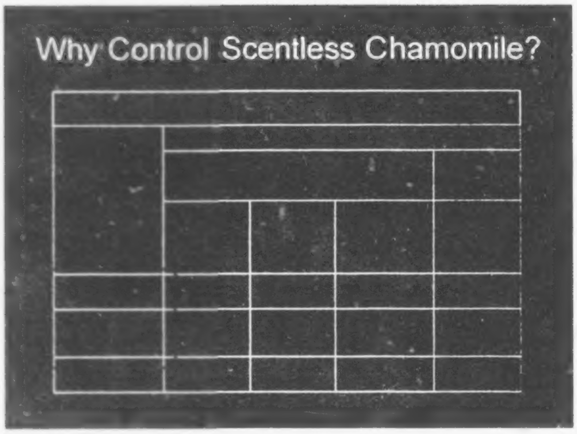
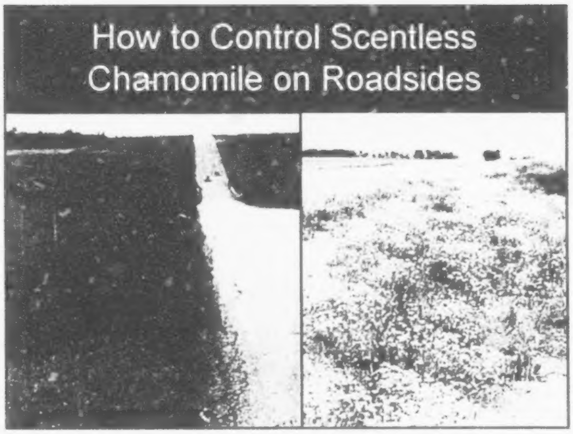


Why Control Scentless Chamomile?



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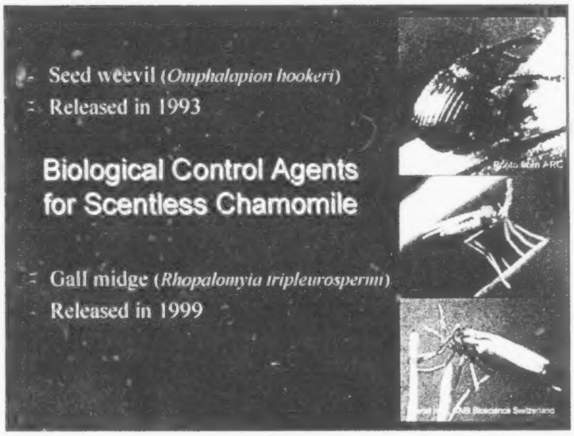

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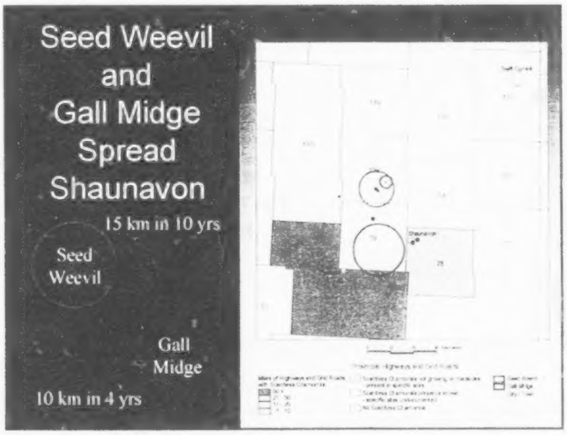
Photo from ARC
CABI Bioscience Switzerland



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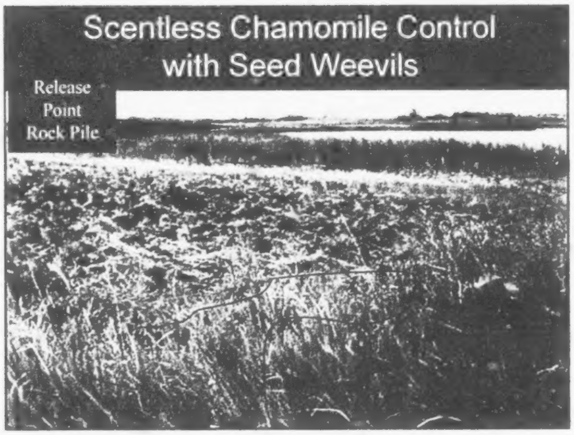

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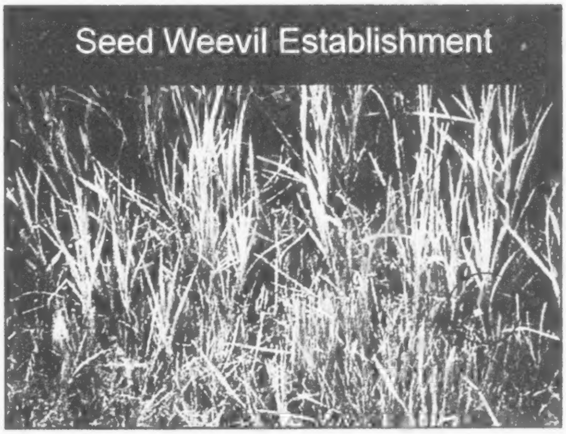

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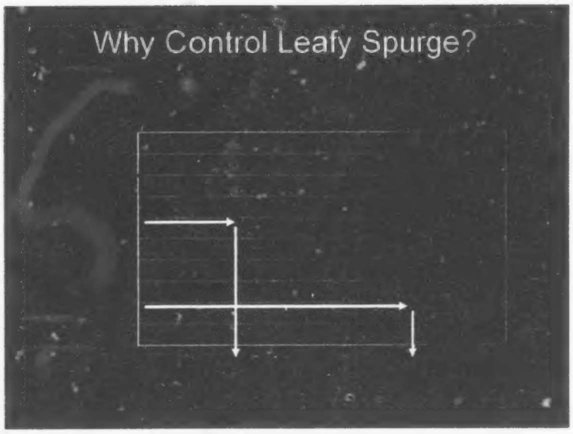

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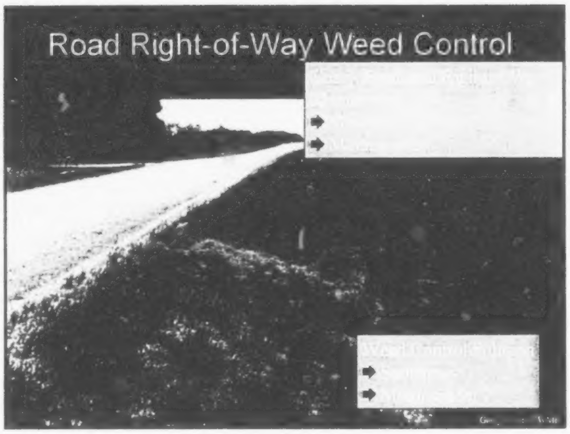
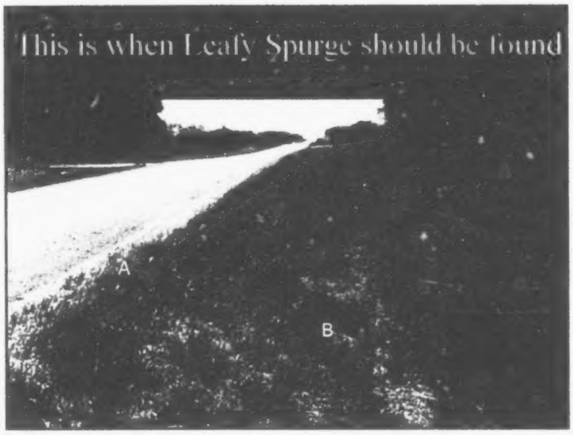
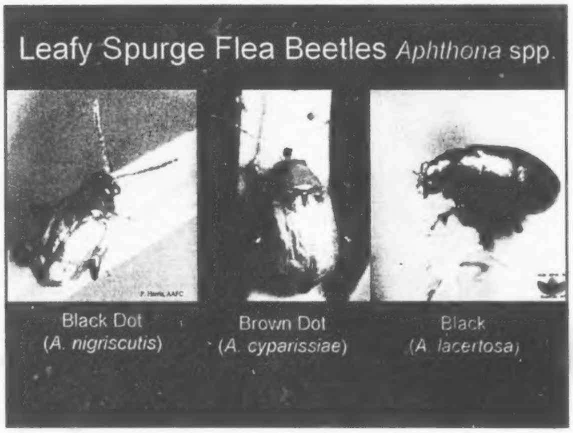


Road Right-of-Way Weed Control



This is when Leafy Spurge should be found

Contain and Control Leafy Spurge



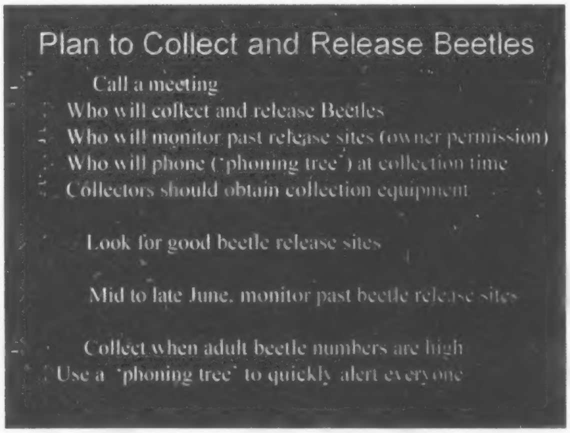
Leafy Spurge Flea Beetles *Aphthona* spp.

P. Harris, AAFC

Black Dot (*A. nigriscutis*)

Brown Dot (*A. cyparissiae*)

Black (*A. lacertosa*)



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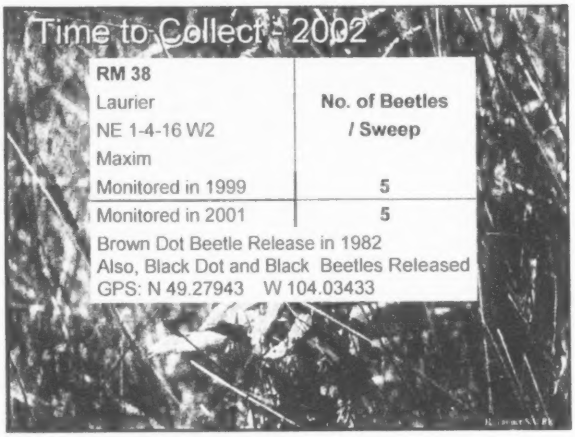

Time to Collect - 2002

RM 38 Laurier NE 1-4-16 W2 Maxim	No. of Beetles / Sweep
Monitored in 1999	5
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Also, Black Dot and Black Beetles Released
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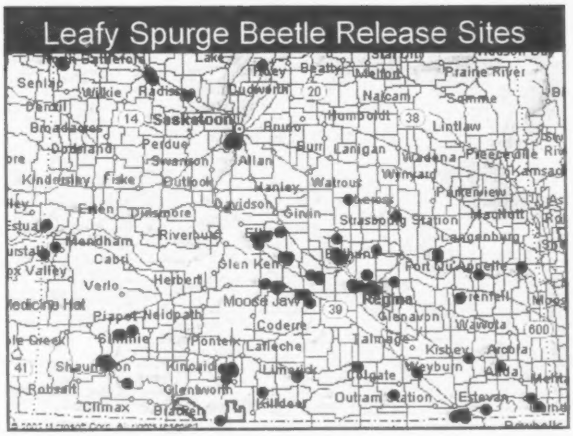
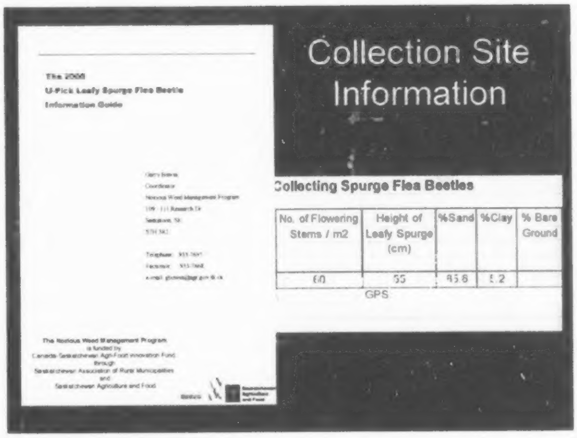


Leafy Spurge Beetle Release Sites



Collection Site Information

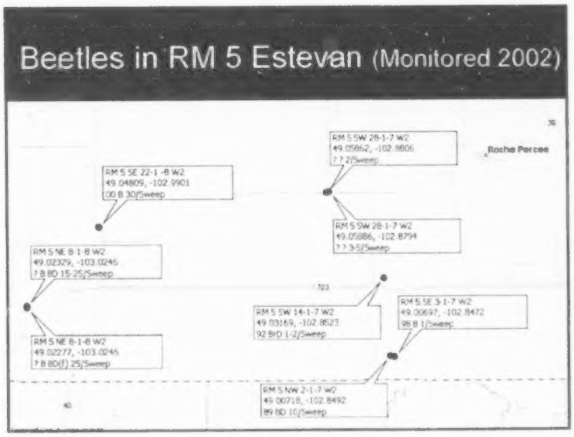
The 2000
U-Pick Leafy Spurge Flea Beetle
Information Guide

The Noxious Weed Management Program
is funded by
Canada-Saskatchewan Agri-Food Innovation Fund
through
Saskatchewan Association of Rural Municipalities
and
Saskatchewan Agriculture and Food

Collecting Spurge Flea Beetles

No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
60	55	85.6	5.2	

GPS



Beetles in RM 5 Estevan (Monitored 2002)

RM 5 SW 28-1-7 W2
49.05862, -102.8806
? ? 2/Sweep

RM 5 SE 22-1-8 W2
49.04809, -102.9901
00 B 30/Sweep

RM 5 SW 28-1-7 W2
49.05886, -102.8794
? ? 3-5/Sweep

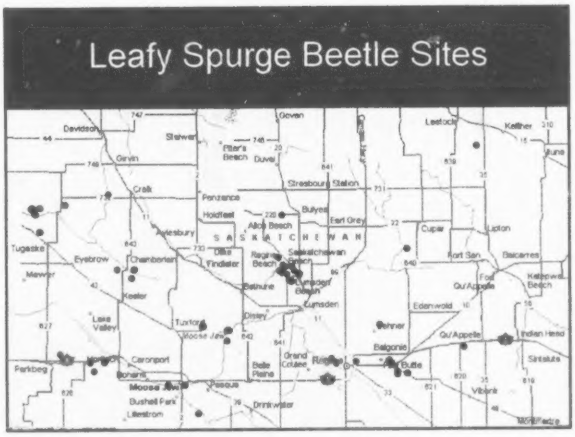
RM 5 NE 8-1-8 W2
49.02329, -103.0246
? B BD 15-25/Sweep

RM 5 SW 14-1-7 W2
49.03169, -102.8523
92 BrD 1-2/Sweep

RM 5 SE 3-1-7 W2
49.00697, -102.8472
98 B 1/Sweep

RM 5 NE 8-1-8 W2
49.02277, -103.0246
? B BD(f) 25/Sweep

RM 5 NW 2-1-7 W2
49.00718, -102.8492
89 BD 10/Sweep



Leafy Spurge Beetle Sites

Future: Noxious Weed Program

- Seed weevils and gall midges will be collected in SK and redistributed in SK
  - New techniques
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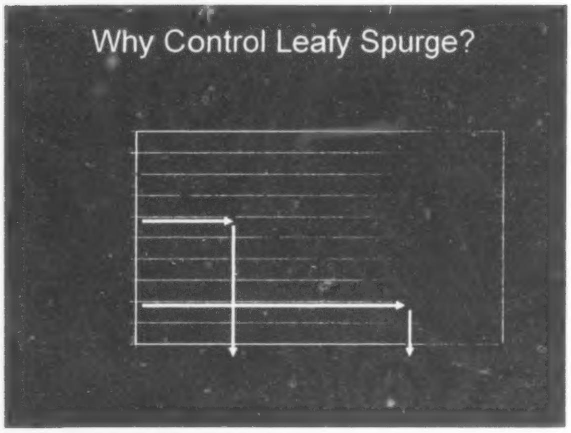
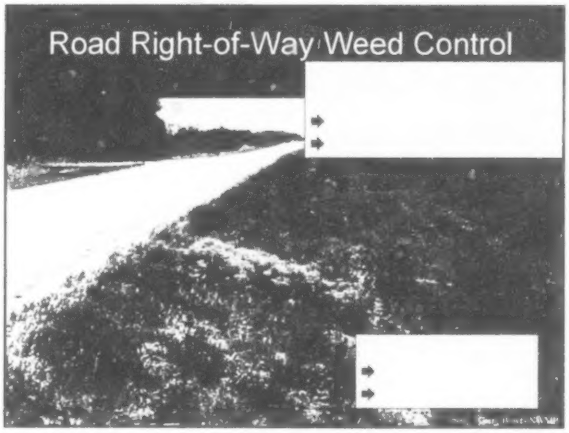
- Information directly to Weed Inspectors
- WI Record Keeping: (1) location (GPS), (2) method
- Weed Maps

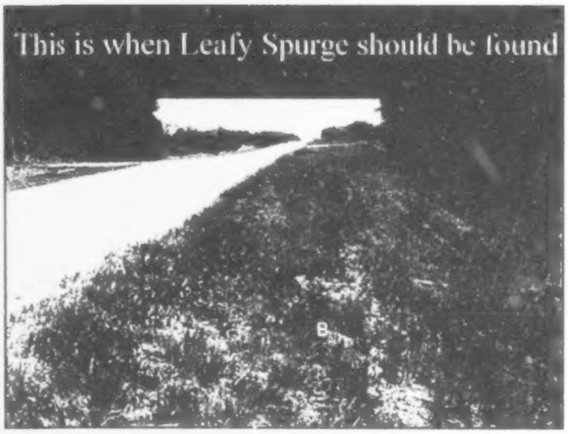
Why Control Leafy Spurge?



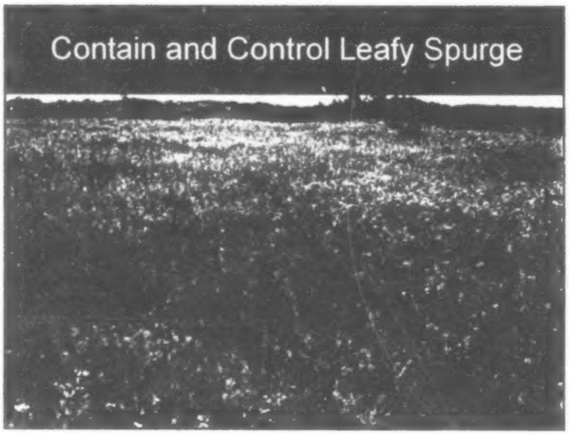
Road Right-of-Way Weed Control



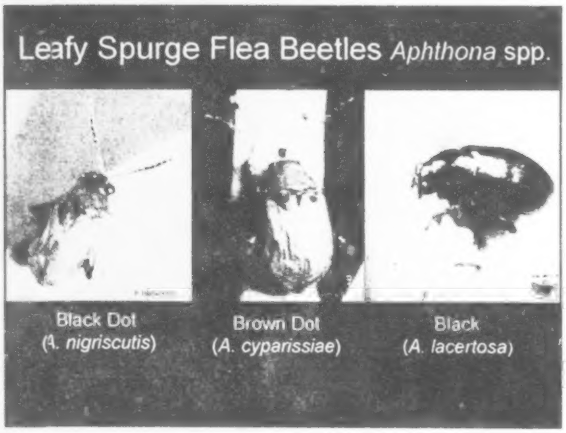
This is when Leafy Spurge should be found



Contain and Control Leafy Spurge



Leafy Spurge Flea Beetles *Aphthona* spp.



Black Dot
(*A. nigriscutis*)

Brown Dot
(*A. cyparissiae*)

Black
(*A. lacertosa*)

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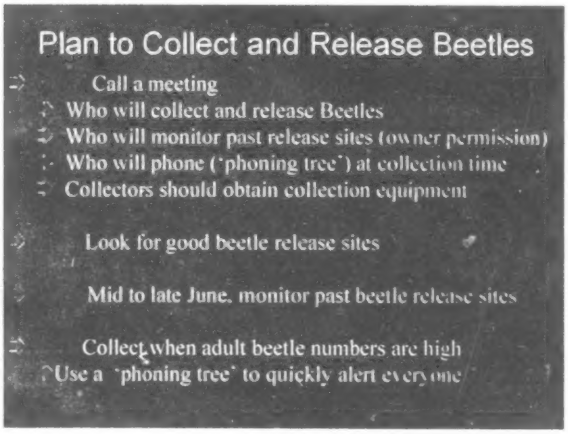

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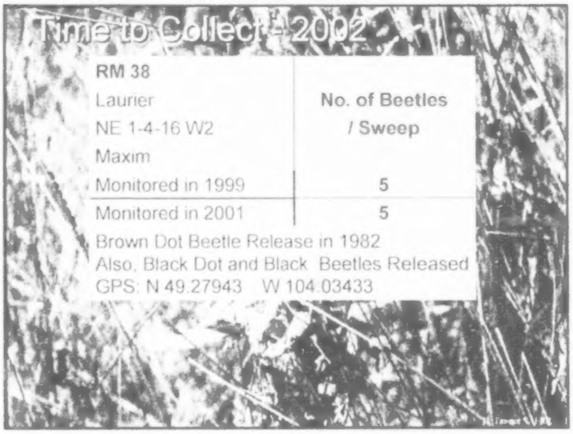

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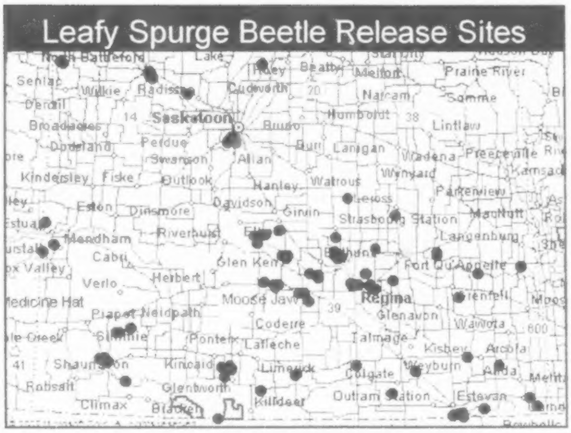

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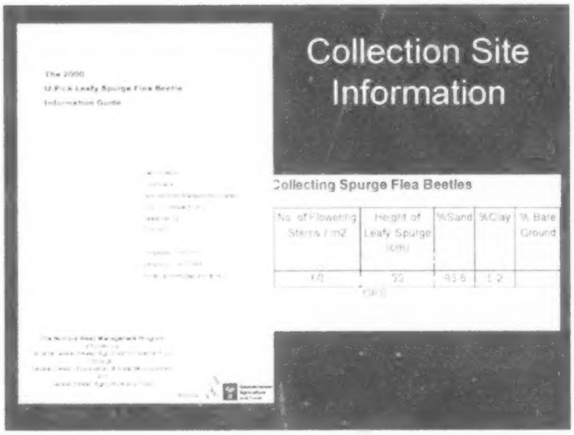

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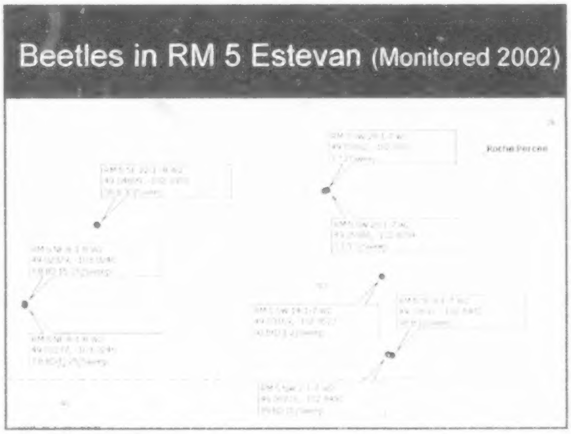

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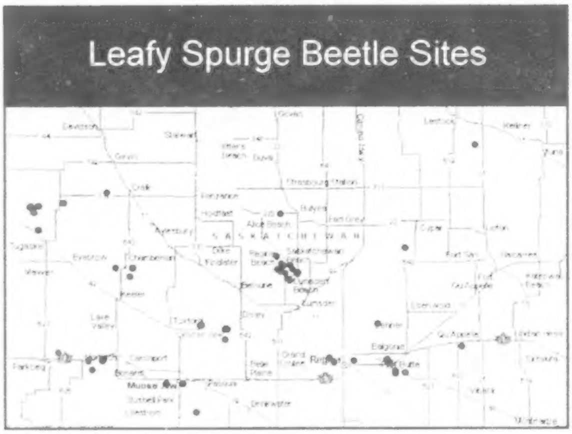
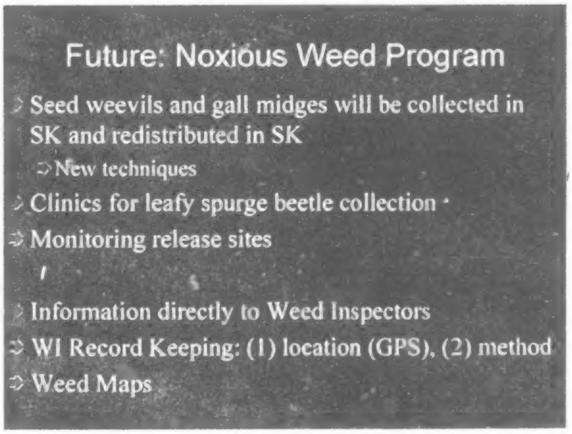


Leafy Spurge Beetle Sites



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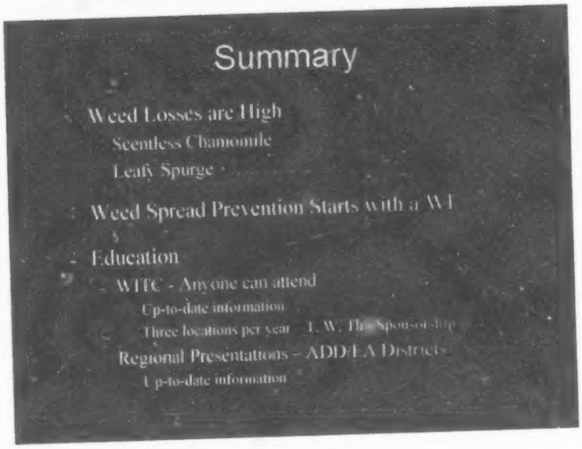

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- Weed Losses are High
  - Scentless Chamomile
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- Weed Spread Prevention Starts with a WI
  S
- Education
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    - Three locations per year – L. W. Th[illegible] Sponsorship
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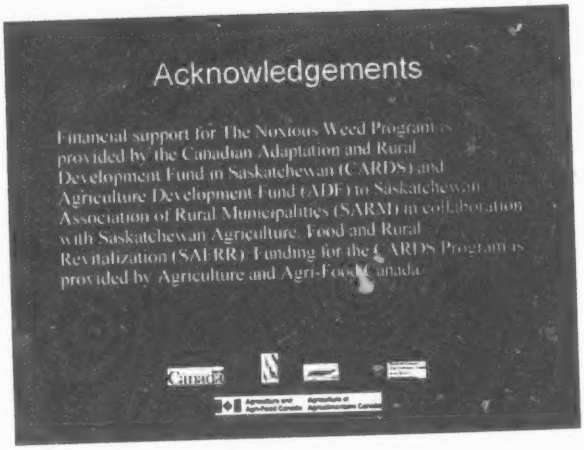

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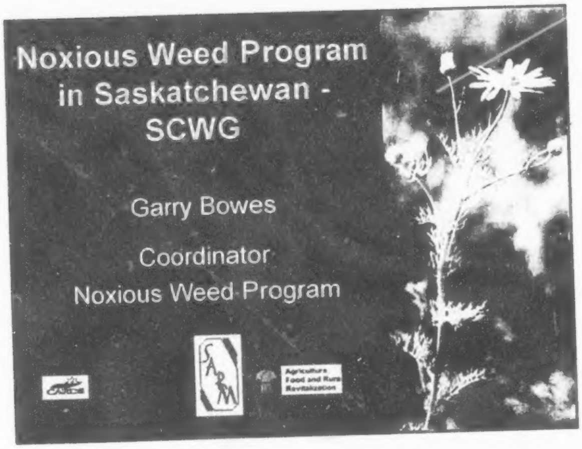
Canada

Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

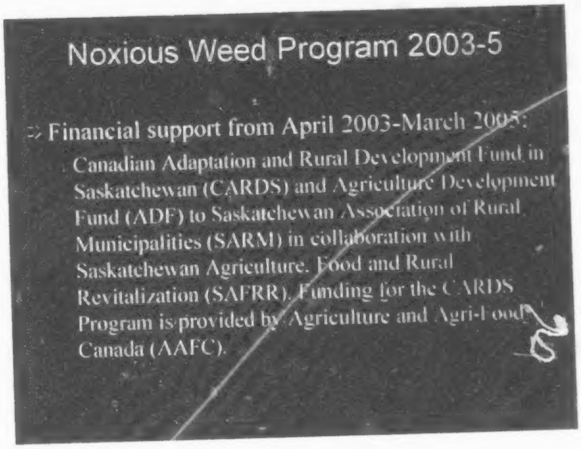


Noxious Weed Program in Saskatchewan - SCWG

Garry Bowes

Coordinator
Noxious Weed Program

Agriculture Food and Rural Revitalization



Noxious Weed Program 2003-5

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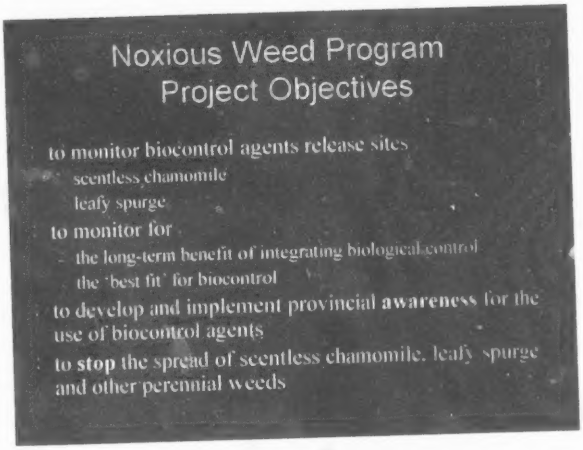

Noxious Weed Program Project Objectives

- to monitor biocontrol agents release sites
  - scentless chamomile
  - leafy spurge
- to monitor for
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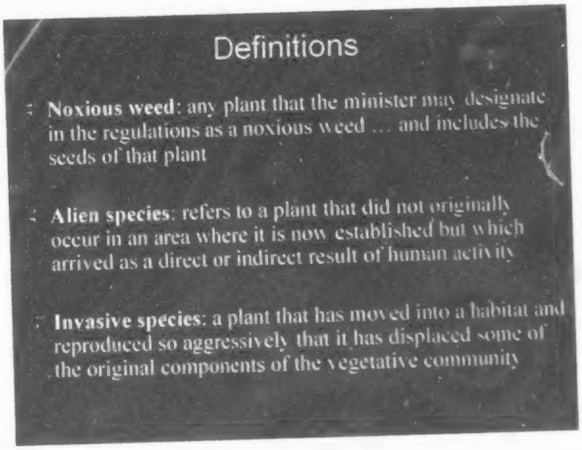

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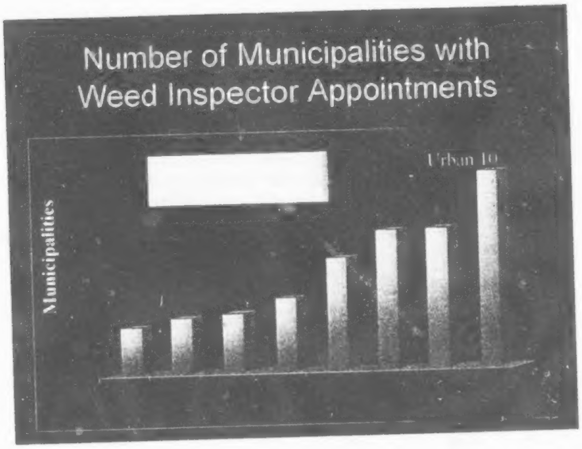

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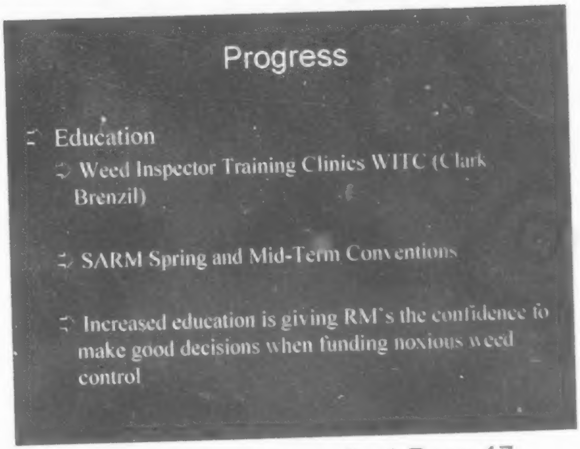

Progress

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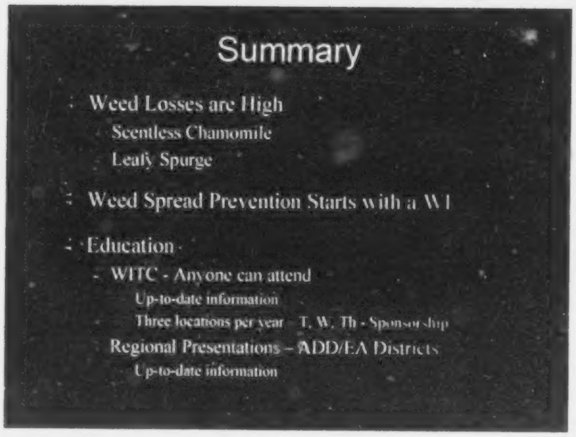

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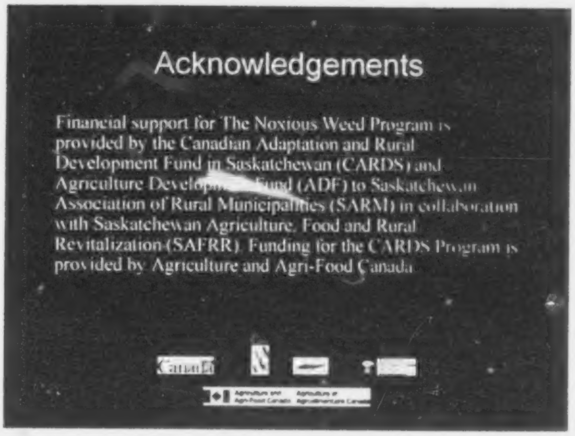

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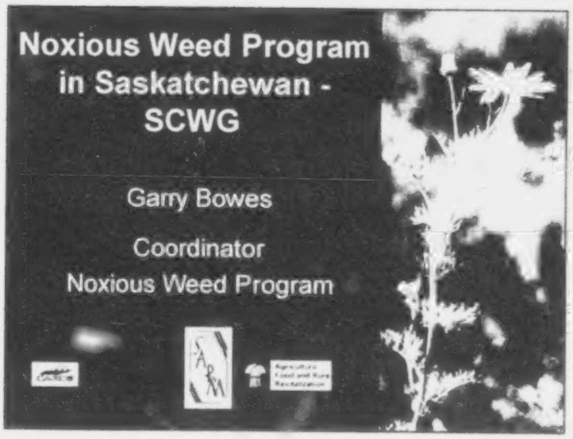

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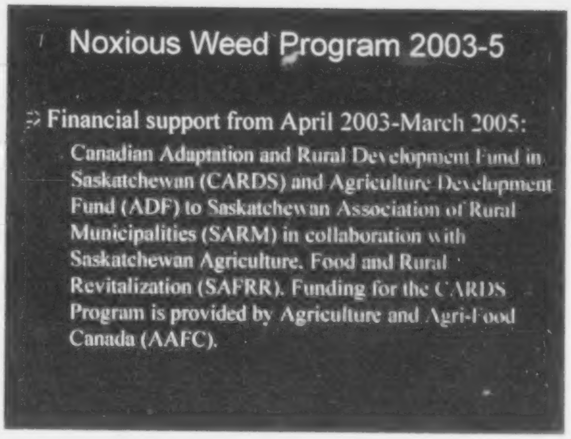

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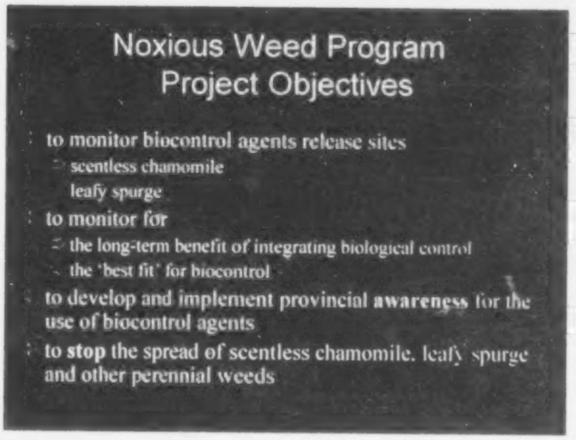

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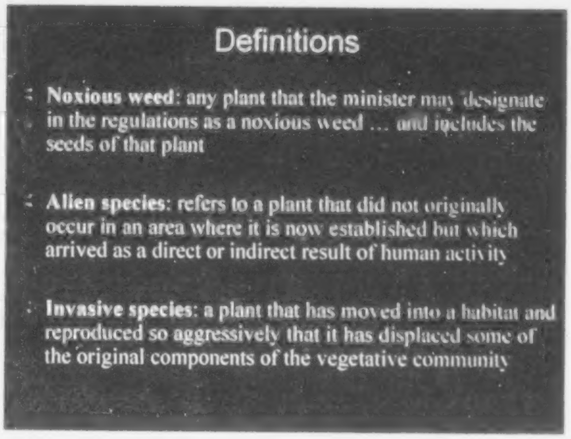

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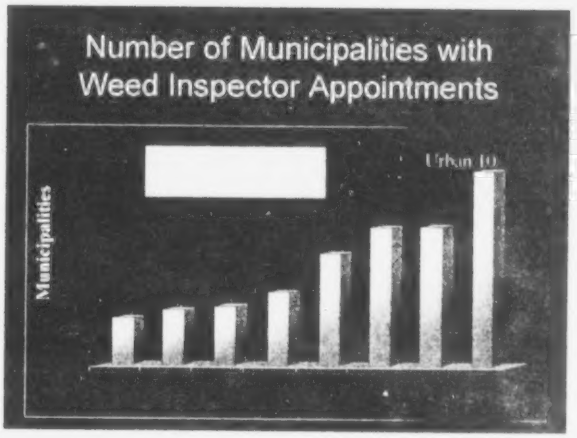

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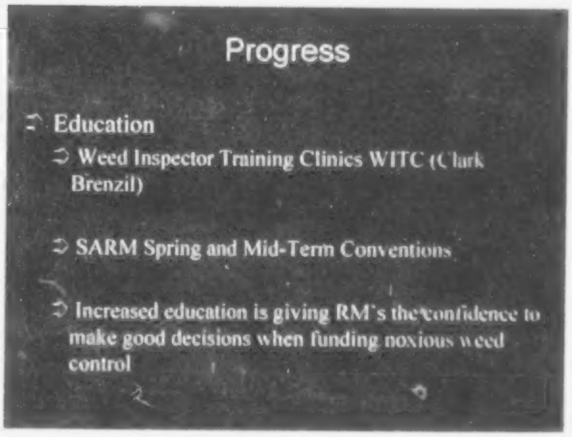

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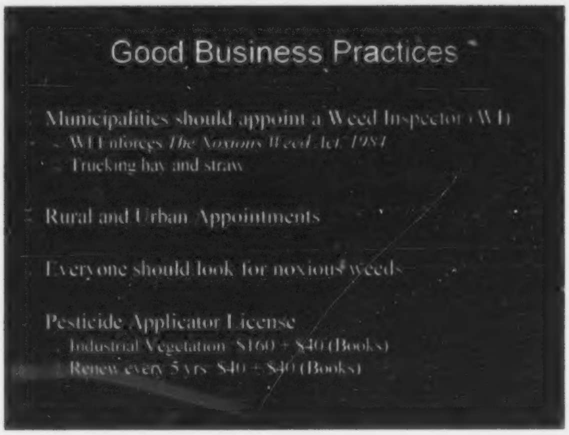

Good Business Practices

- Municipalities should appoint a Weed Inspector (WI)
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  - Trucking hay and straw
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- Everyone should look for noxious weeds
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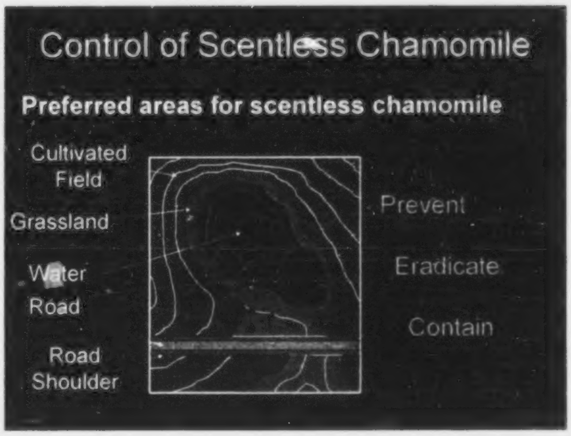
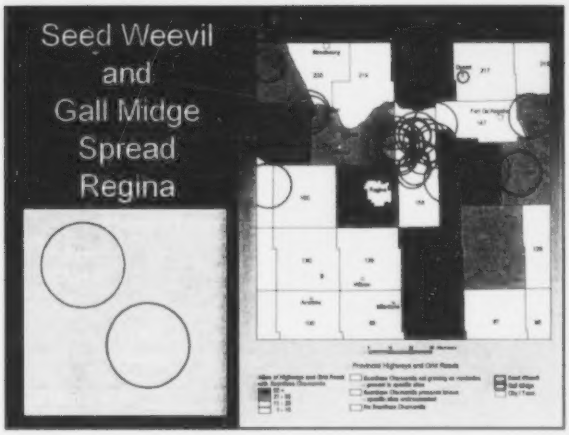
  - Industrial Vegetation $160 + $40 (Books)
  - Renew every 5 yrs $40 + $40 (Books)

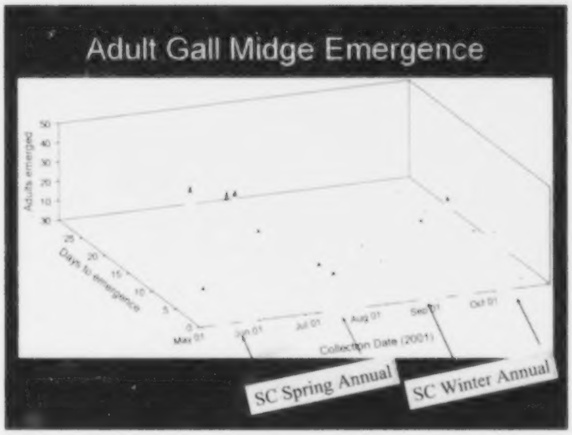


Control of Scentless Chamomile

Preferred areas for scentless chamomile

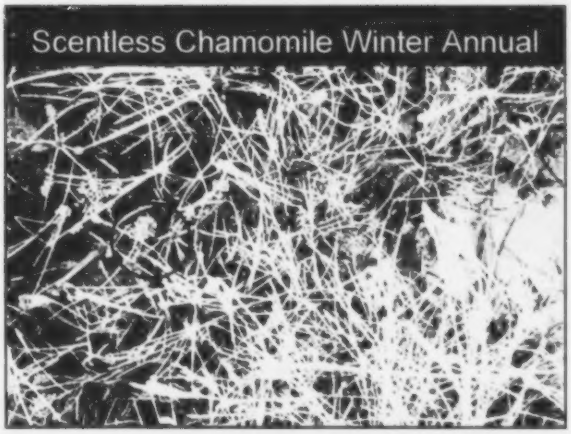


Seed Weevil and Gall Midge Spread Regina

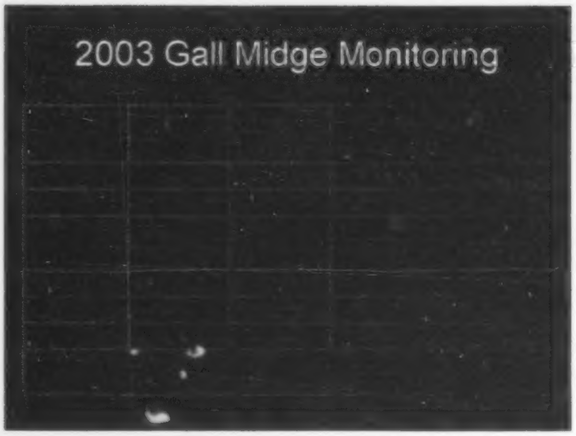


Adult Gall Midge Emergence

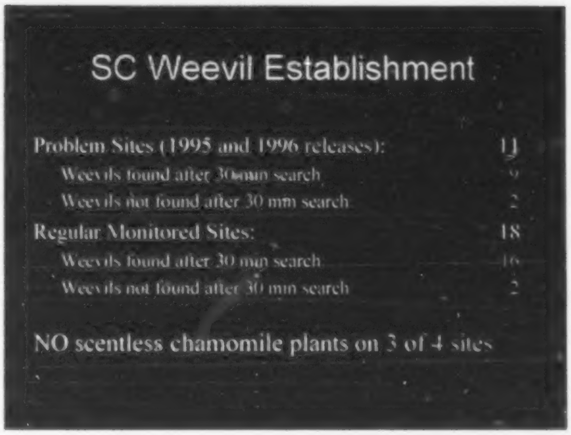
Scentless Chamomile Spring Annual



Scentless Chamomile Winter Annual



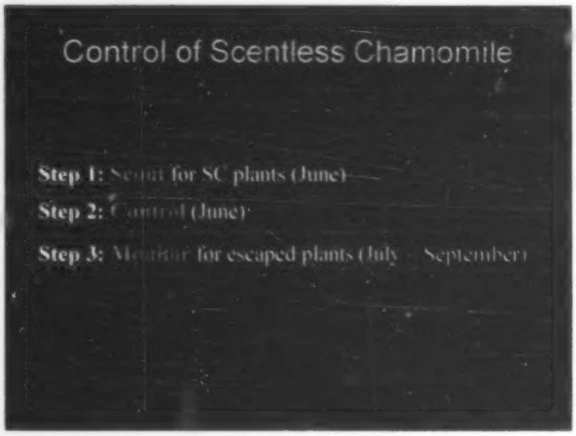
2003 Gall Midge Monitoring



SC Weevil Establishment

Problem Sites (1995 and 1996 releases):	11
Weevils found after 30 min search	9
Weevils not found after 30 min search	2
Regular Monitored Sites:	18
Weevils found after 30 min search	16
Weevils not found after 30 min search	2

NO scentless chamomile plants on 3 of 4 sites

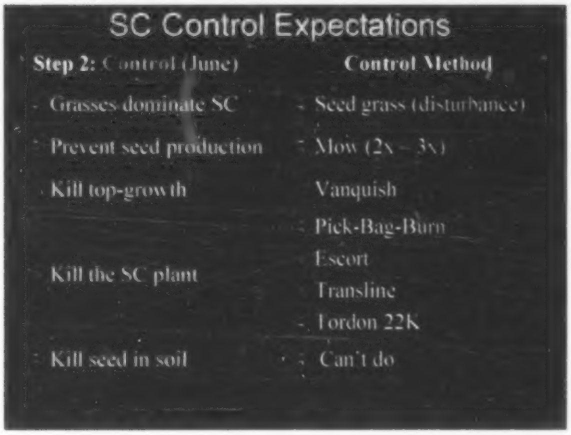


Control of Scentless Chamomile

Step 1: Scout for SC plants (June)

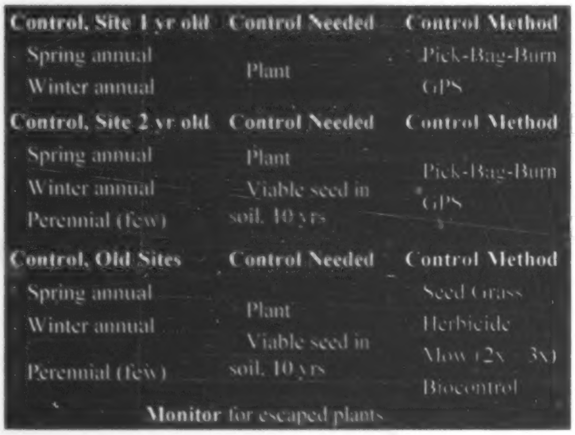
Step 2: Control (June)

Step 3: Monitor for escaped plants (July – September)



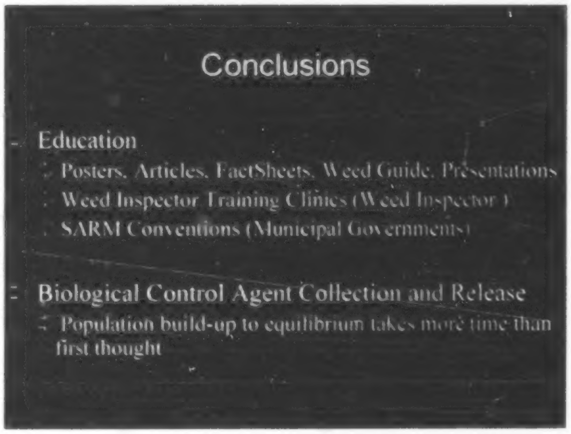
SC Control Expectations

Step 2: Control (June)	**Control Method**
Grasses dominate SC	Seed grass (disturbance)
Prevent seed production	Mow (2x – 3x)
Kill top-growth	Vanquish
Kill the SC plant	Pick-Bag-Burn Escort Transline Tordon 22K
Kill seed in soil	Can't do



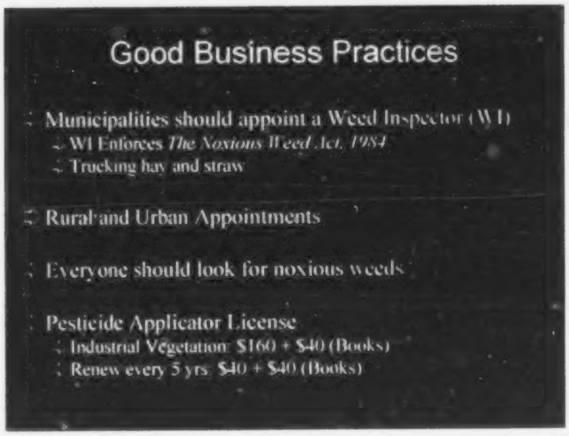
Control, Site 1 yr old	**Control Needed**	**Control Method**
Spring annual Winter annual	Plant	Pick-Bag-Burn GPS
Control, Site 2 yr old	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil, 10 yrs	Pick-Bag-Burn GPS
Control, Old Sites	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil, 10 yrs	Seed Grass Herbicide Mow (2x – 3x) Biocontrol

Monitor for escaped plants



Conclusions

- Education
  - Posters, Articles, FactSheets, Weed Guide, Presentations
  - Weed Inspector Training Clinics (Weed Inspector)
  - SARM Conventions (Municipal Governments)
- Biological Control Agent Collection and Release
  - Population build-up to equilibrium takes more time than first thought



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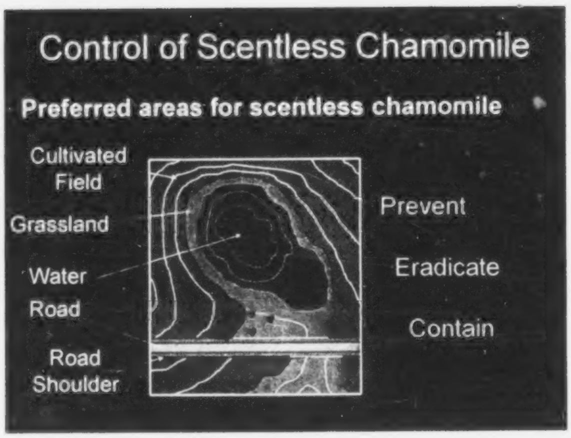
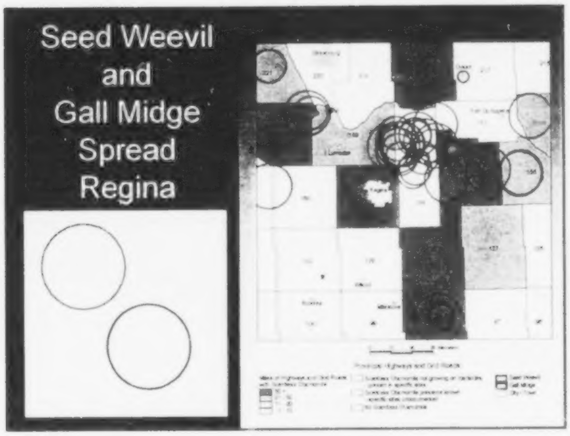
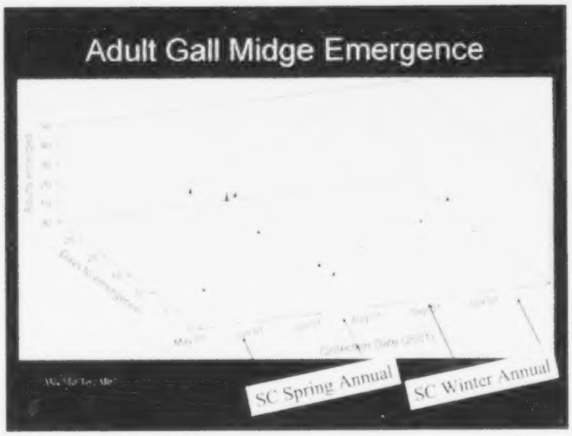


Control of Scentless Chamomile

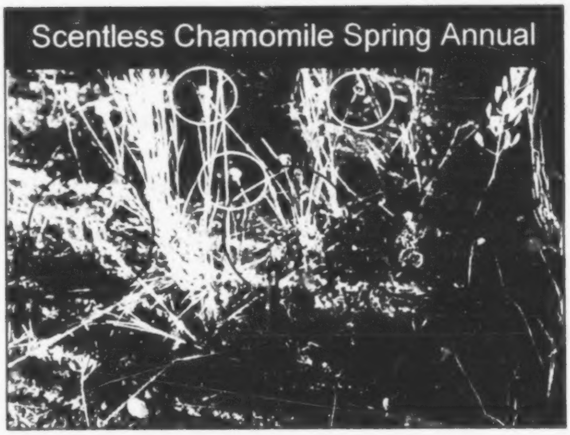
Preferred areas for scentless chamomile



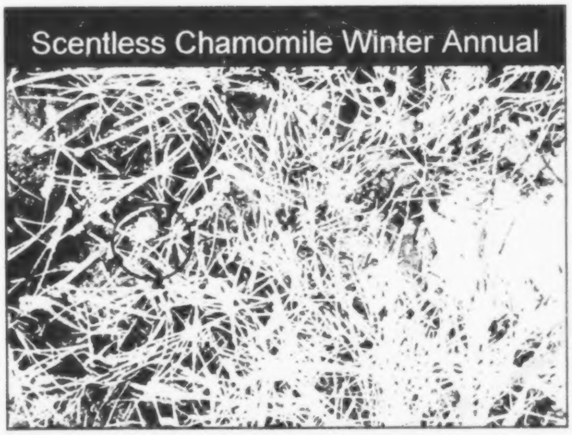
Seed Weevil and Gall Midge Spread Regina



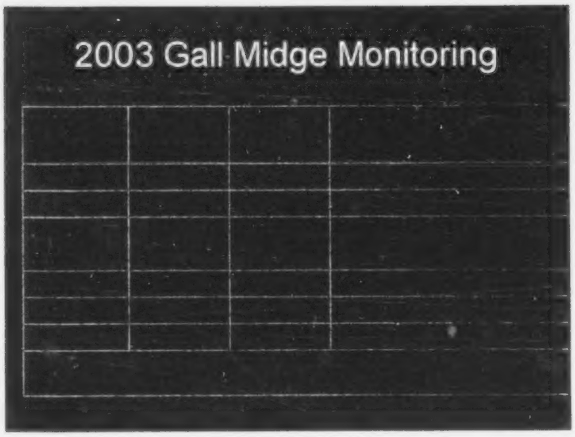
Adult Gall Midge Emergence



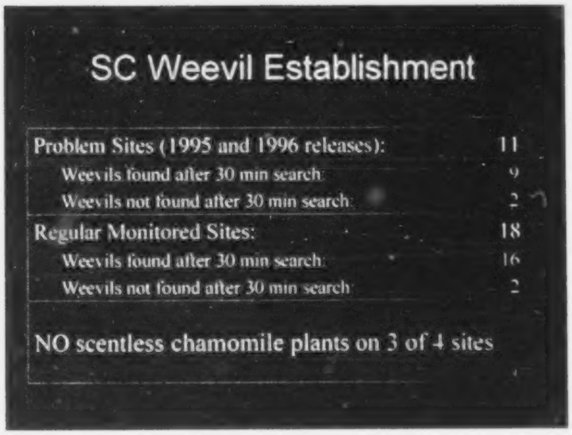
Scentless Chamomile Spring Annual



Scentless Chamomile Winter Annual



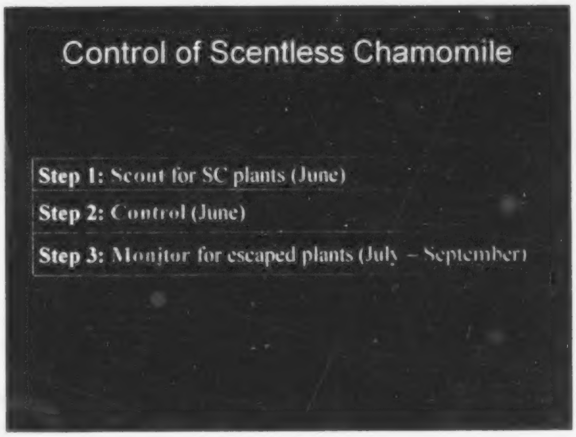
2003 Gall Midge Monitoring



SC Weevil Establishment

Problem Sites (1995 and 1996 releases):	11
Weevils found after 30 min search:	9
Weevils not found after 30 min search:	2
Regular Monitored Sites:	18
Weevils found after 30 min search:	16
Weevils not found after 30 min search:	2

NO scentless chamomile plants on 3 of 4 sites

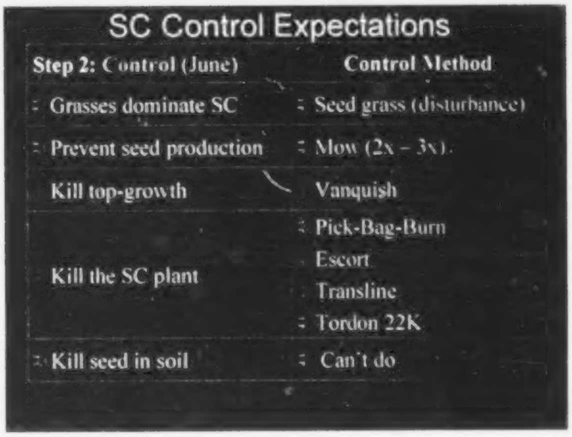


Control of Scentless Chamomile

Step 1: Scout for SC plants (June)

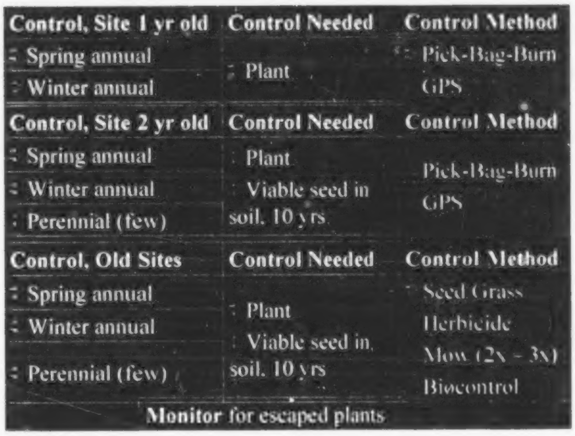
Step 2: Control (June)

Step 3: Monitor for escaped plants (July – September)



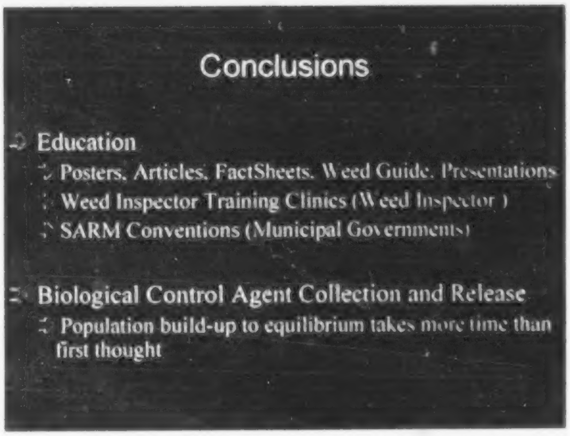
SC Control Expectations

Step 2: Control (June)	**Control Method**
Grasses dominate SC	Seed grass (disturbance)
Prevent seed production	Mow (2x – 3x)
Kill top-growth	Vanquish
Kill the SC plant	Pick-Bag-Burn Escort Transline Tordon 22K
Kill seed in soil	Can't do



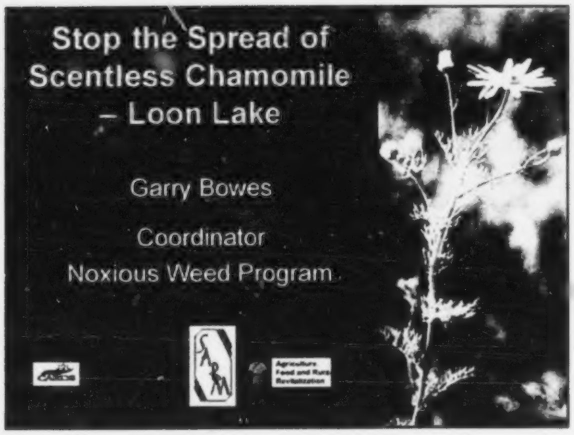
Control, Site 1 yr old	**Control Needed**	**Control Method**
Spring annual Winter annual	Plant	Pick-Bag-Burn GPS
Control, Site 2 yr old	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil, 10 yrs	Pick-Bag-Burn GPS
Control, Old Sites	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil, 10 yrs	Seed Grass Herbicide Mow (2x - 3x) Biocontrol

Monitor for escaped plants



Conclusions

- Education
  - Posters, Articles, FactSheets, Weed Guide, Presentations
  - Weed Inspector Training Clinics (Weed Inspector)
  - SARM Conventions (Municipal Governments)
- Biological Control Agent Collection and Release
  - Population build-up to equilibrium takes more time than first thought



Stop the Spread of Scentless Chamomile – Loon Lake

Garry Bowes

Coordinator

Noxious Weed Program

Definitions

Noxious weed: any plant that the minister may designate as a noxious weed … and includes the seeds of that plant

Alien species: refers to a plant that did not originally occur in an area where it is now established but which arrived as a direct or indirect result of human activity

Invasive species: a plant that has moved into a habitat and reproduced so aggressively that it has displaced some of the original components of the vegetative community

The Noxious Weed Act, 1984

Good Business Practices for Municipalities

- Municipalities should appoint a Weed Inspector (WI)
  - WI Enforces *The Noxious Weed Act, 1984*
- Rural and urban municipalities should appoint WI
- Everyone should look for noxious weeds
- Pesticide Applicator License
  - Industrial Vegetation: $160 + $40 (Books)
  - Renew every 5 yrs: $40 + $40 (Books)

Role of the Weed Inspector

Primary

- Enforce *The Noxious Weeds Act*
  - Ensure that infestations are controlled by land owner
    - Private, corporate, or municipal

Secondary

- Coordinate weed control activities in the municipality
  - Monitoring for weed infestations – mapping, records
  - Assessing effectiveness of controls and plan for future activity
  - Participate in biocontrol activities where needed

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- The Weed Inspector is not the Pesticide Applicator
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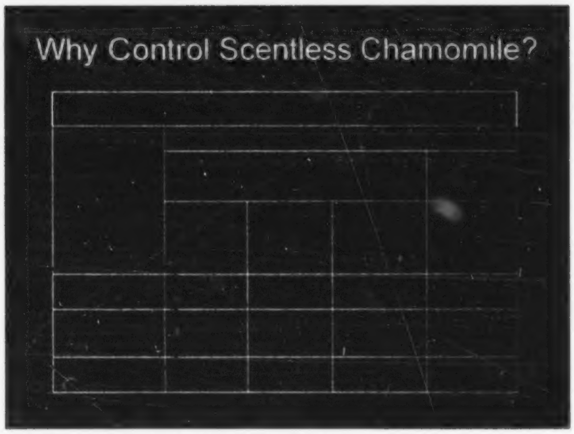
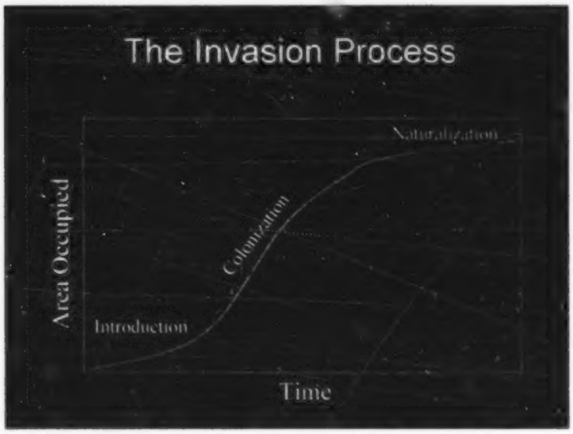
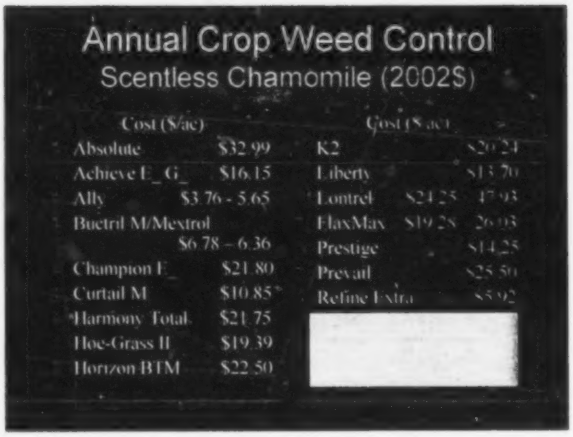
Why Control Scentless Chamomile?



The Invasion Process





Annual Crop Weed Control

Scentless Chamomile (2002$)

	Cost ($/ac)		Cost ($/ac)
Absolute	$32.99	K2	$20.24
Achieve E_G_	$16.15	Liberty	$13.70
Ally	$3.76 - 5.65	Lontrel	$24.25 47.93
Buctril M/Mextrol	$6.78 – 6.36	FlaxMax	$19.28 26.93
Champion E_	$21.80	Prestige	$14.25
Curtail M	$10.85*	Prevail	$25.50
*Harmony Total	$21.75	Refine Extra	$5.92
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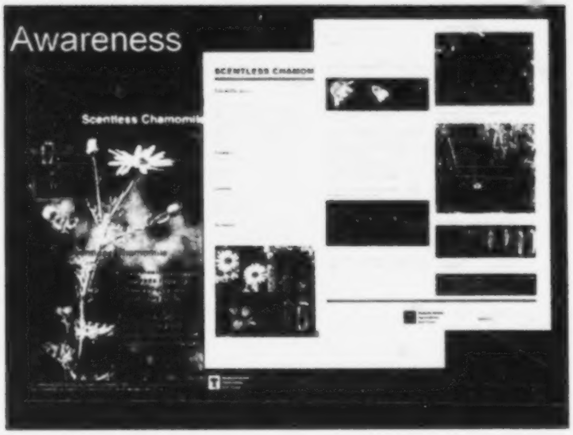
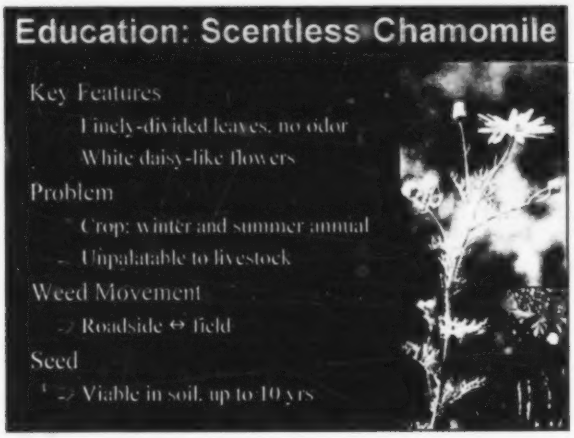


Awareness



Education: Scentless Chamomile

- Key Features
  - Finely-divided leaves, no odor
  - White daisy-like flowers
- Problem
  - Crop: winter and summer annual
  - Unpalatable to livestock
- Weed Movement
  - Roadside ↔ field
- Seed
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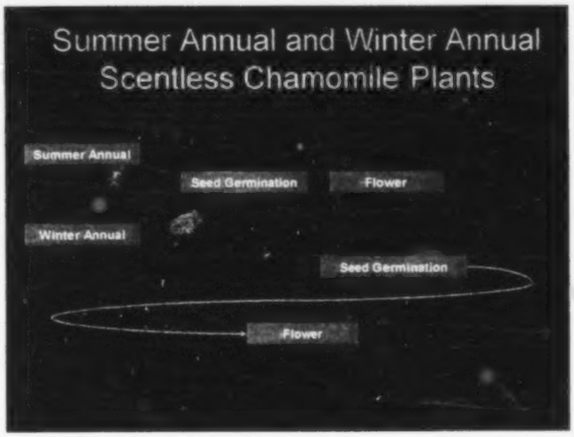
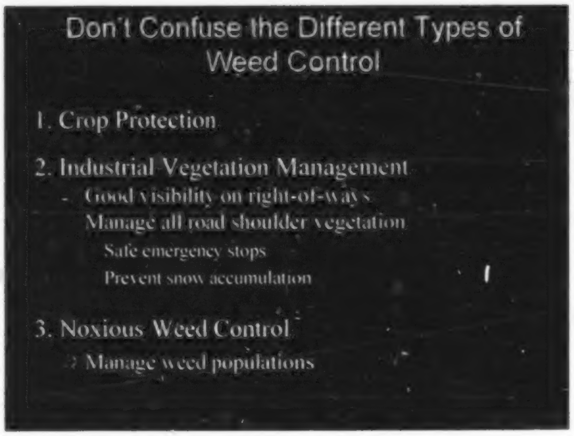


Summer Annual and Winter Annual Scentless Chamomile Plants



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1. Crop Protection
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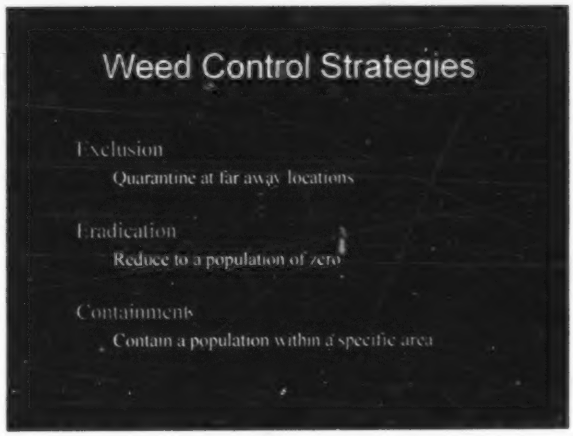

Weed Control Strategies

- Exclusion
  - Quarantine at far away locations
- Eradication
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- Containment
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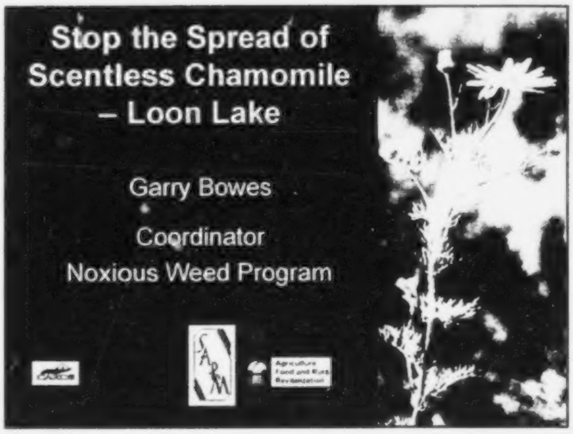


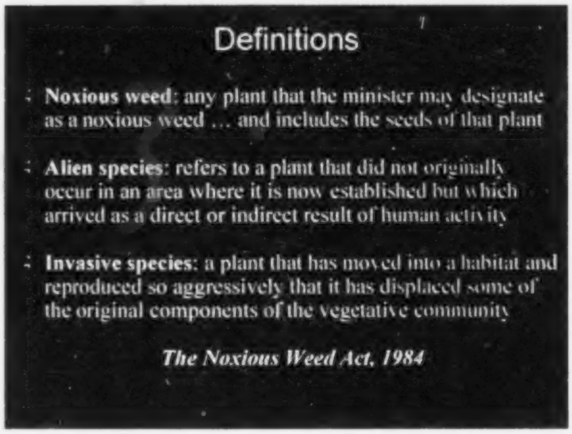
Stop the Spread of Scentless Chamomile – Loon Lake

Garry Bowes

Coordinator

Noxious Weed Program

SARM
Agriculture Food and Rural Revitalization



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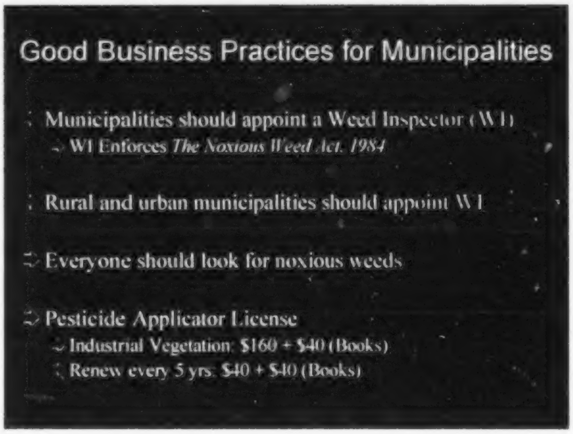

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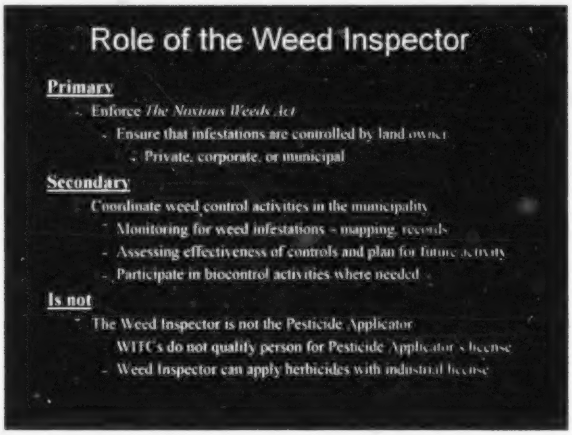

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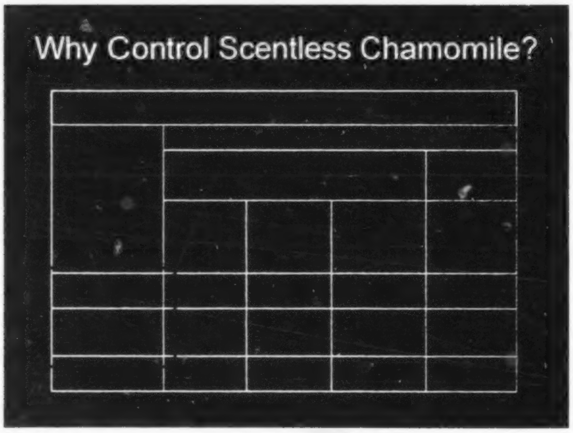
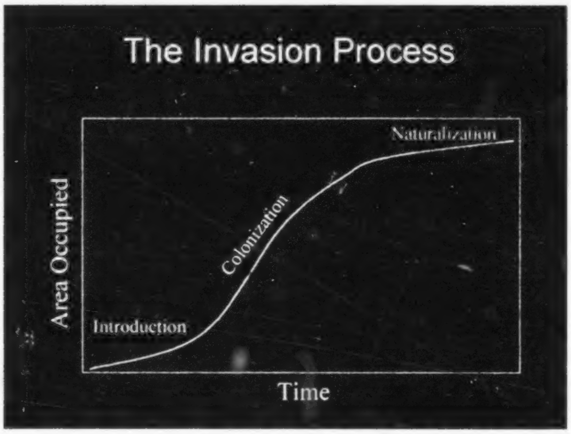


Why Control Scentless Chamomile?



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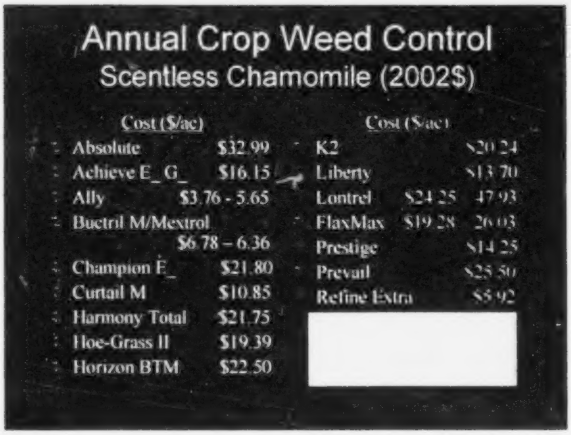

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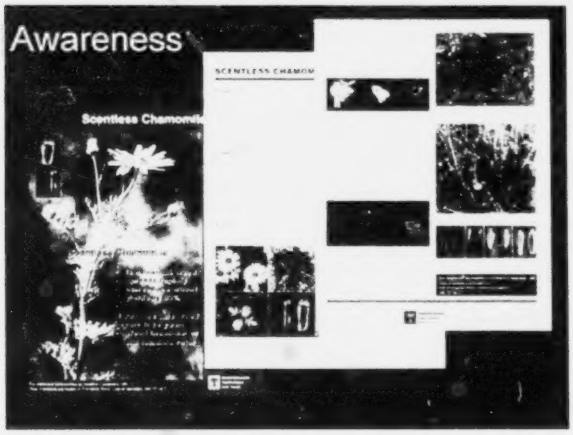
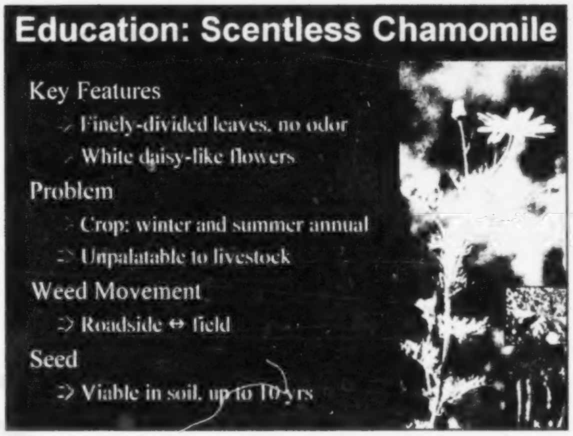


Awareness



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Weed Movement
- Roadside ↔ field

Seed
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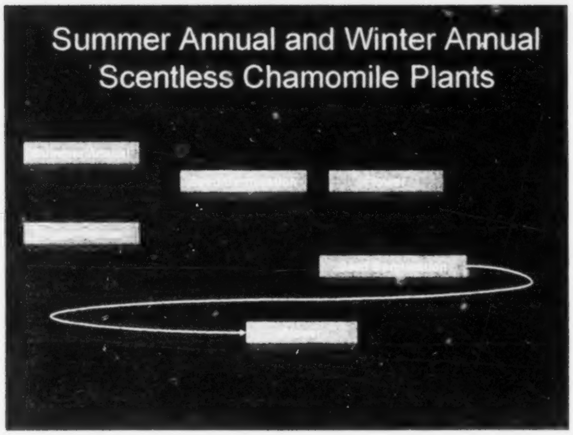
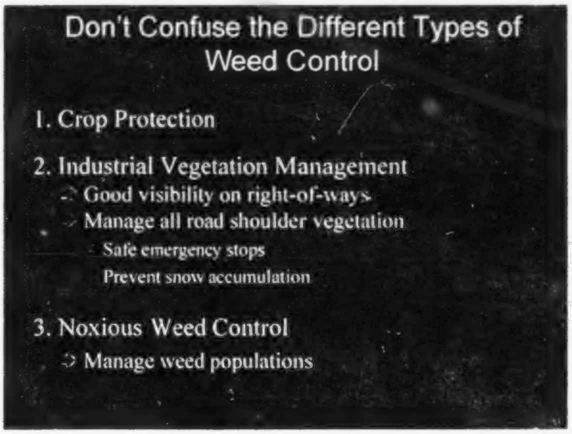


Summer Annual and Winter Annual Scentless Chamomile Plants



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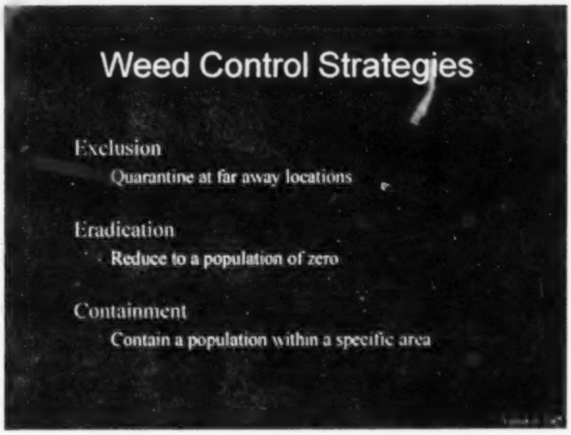

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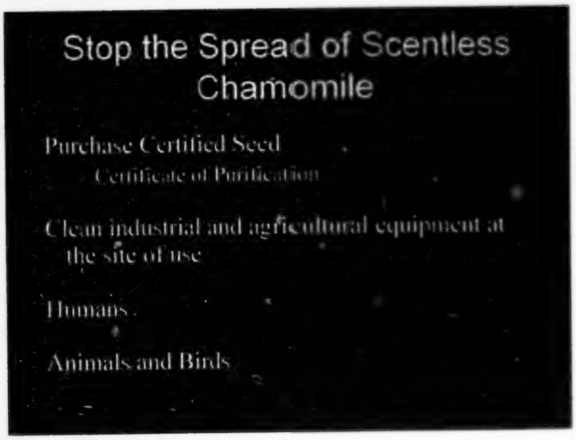
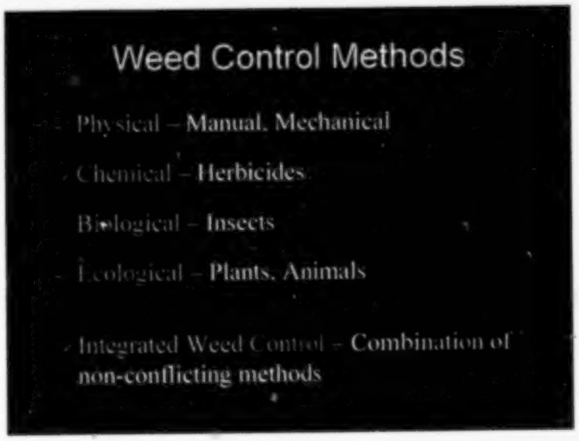


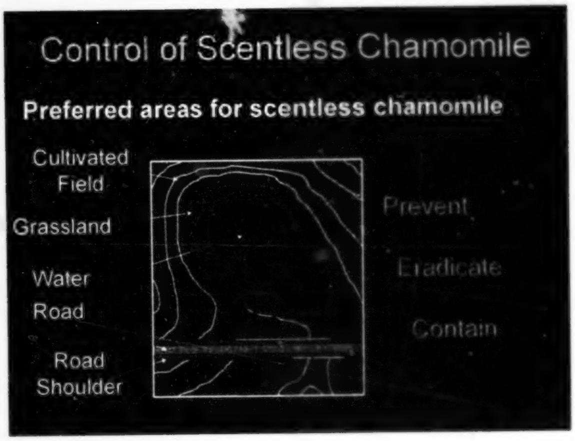
Stop the Spread of Scentless Chamomile

- Purchase Certified Seed
  - Certificate of Purification
- Clean industrial and agricultural equipment at the site of use
- Humans
- Animals and Birds



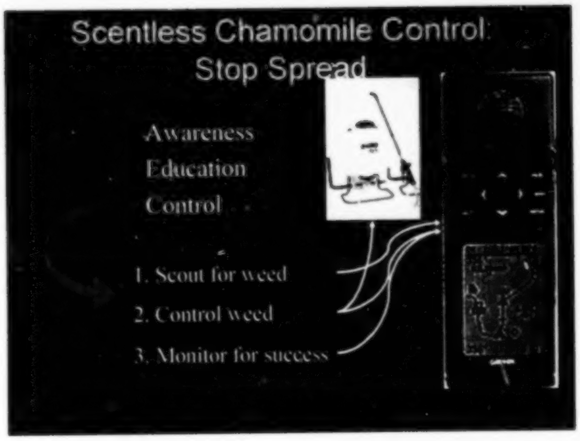
Weed Control Methods

- Physical – **Manual, Mechanical**
- Chemical – **Herbicides**
- Biological – **Insects**
- Ecological – **Plants, Animals**
- Integrated Weed Control – **Combination of non-conflicting methods**



Control of Scentless Chamomile

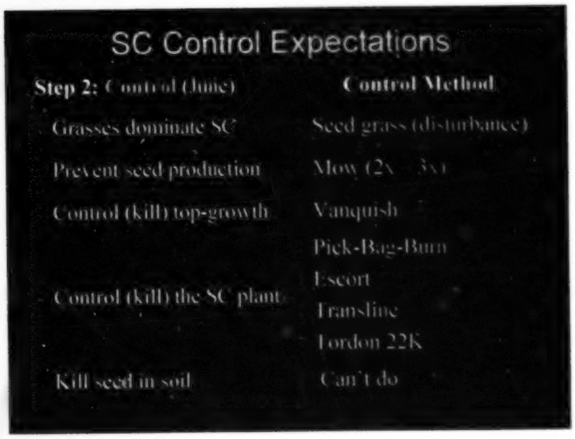
Preferred areas for scentless chamomile



Scentless Chamomile Control: Stop Spread

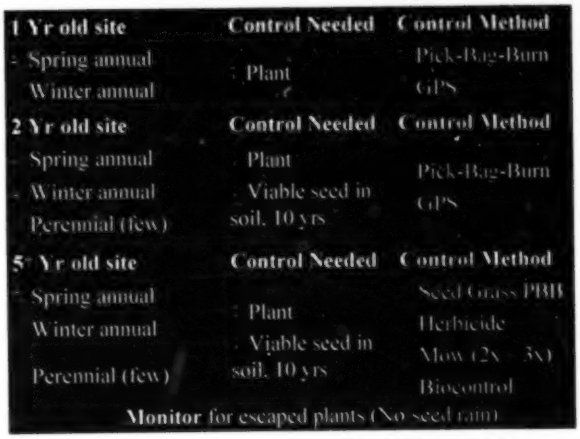
- Awareness
- Education
- Control

1. Scout for weed
2. Control weed
3. Monitor for success



SC Control Expectations

Step 2: Control (June)	**Control Method**
Grasses dominate SC	Seed grass (disturbance)
Prevent seed production	Mow (2x – 3x)
Control (kill) top-growth	Vanquish
Control (kill) the SC plant	Pick-Bag-Burn Escort Transline Tordon 22K
Kill seed in soil	Can't do



1 Yr old site	**Control Needed**	**Control Method**
Spring annual Winter annual	Plant	Pick-Bag-Burn GPS
2 Yr old site	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil, 10 yrs	Pick-Bag-Burn GPS
5+ Yr old site	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil, 10 yrs	Seed Grass PBB Herbicide Mow (2x – 3x) Biocontrol

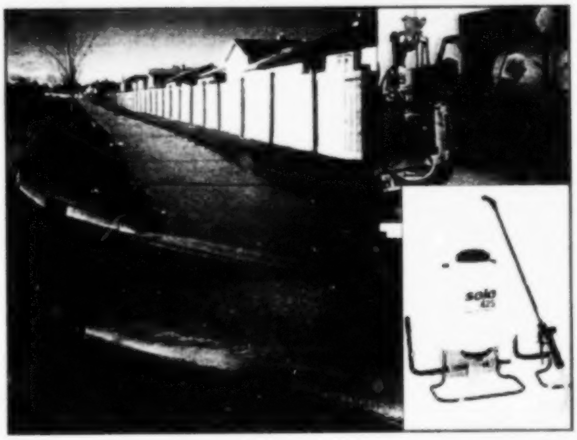
Monitor for escaped plants (No seed rain)

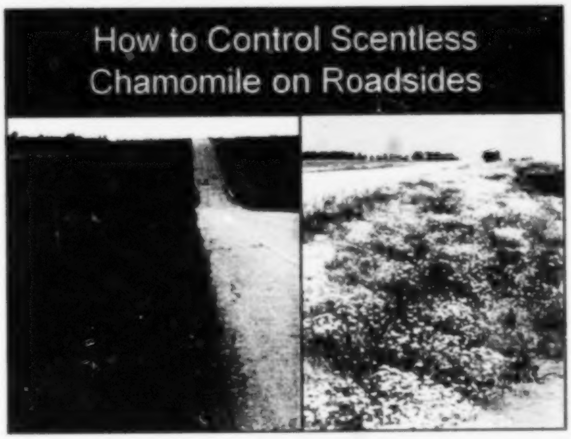
Seed Bank Decline – France

- Scentless Chamomile
  - 1st year, 88% decline
  - 2nd year, 71% decline of remaining seed
  - 3rd year, 56% decline of remaining seed

Industrial Weed Control

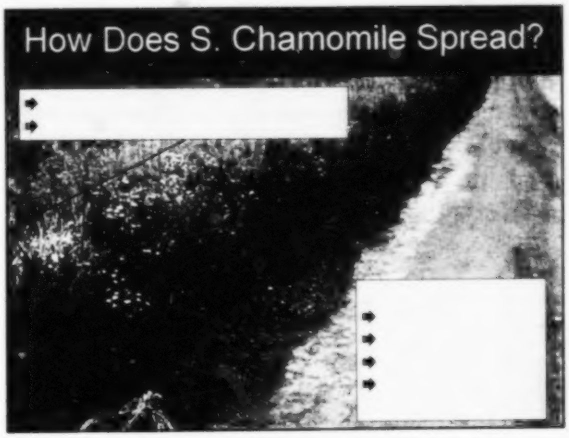
Herbicide Group Cost	Weeds	Rate L or g/ac	Herbicide $/ac
Vanquish 4 $33.00/L	SC Top Growth	0.51	$16.83
Escort 2 $1.65/g	SC Control	8	$13.20
Tordon 22K 4 $41.00/L	SC Control	0.45	$18.45
Transline 4 $135.00/L	SC Control	23	$31.05
Tordon 101 4 $15.00/L	Canada Thistle Dandelion Woody Plants	1.48 1.48 7.2 – 10	$22.20 $22.20 $108.00 – 150.00



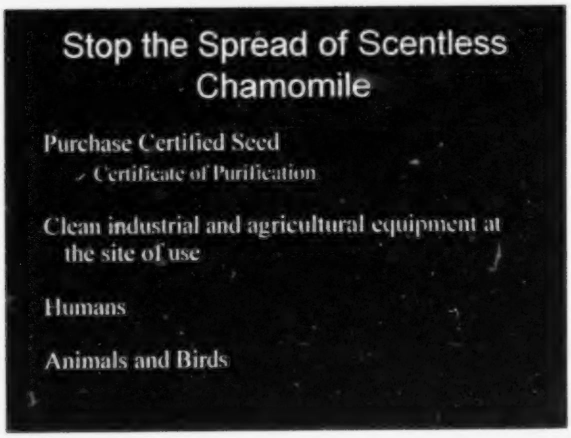


How to Control Scentless Chamomile on Roadsides

Is Competition Perfect?



How Does S. Chamomile Spread?



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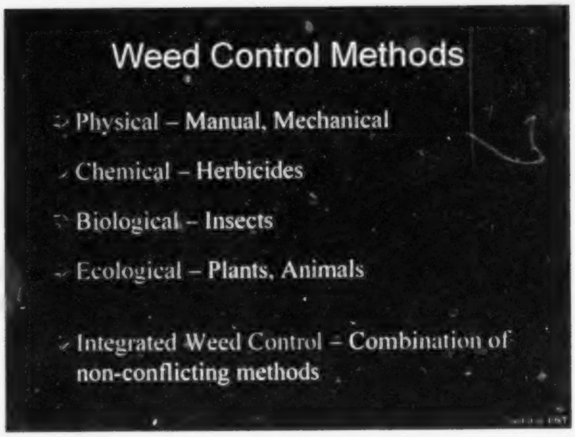

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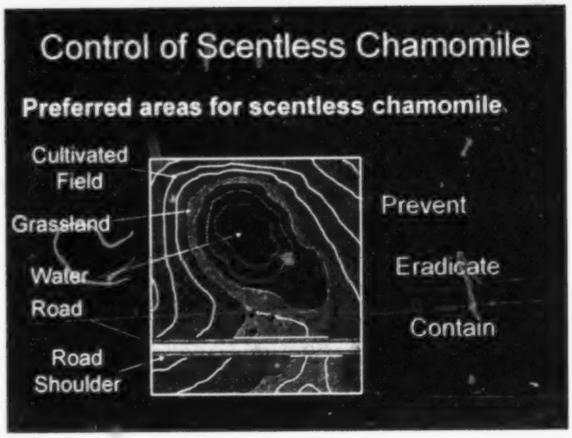


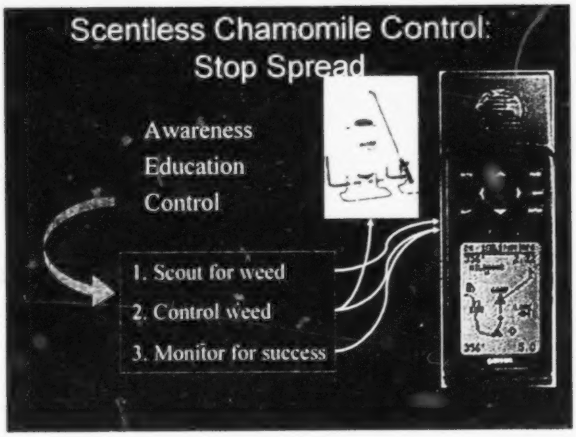
Control of Scentless Chamomile

Preferred areas for scentless chamomile

Prevent

Eradicate

Contain



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Awareness
Education
Control

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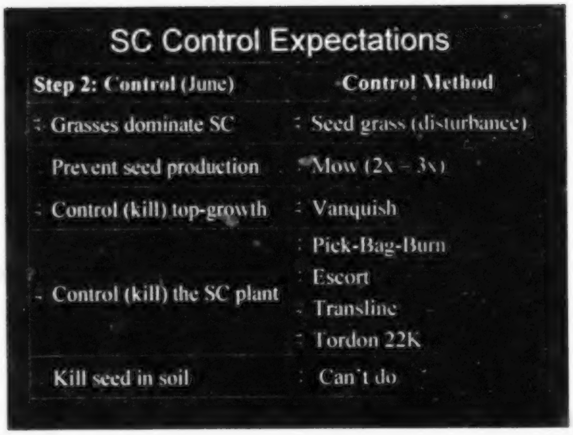

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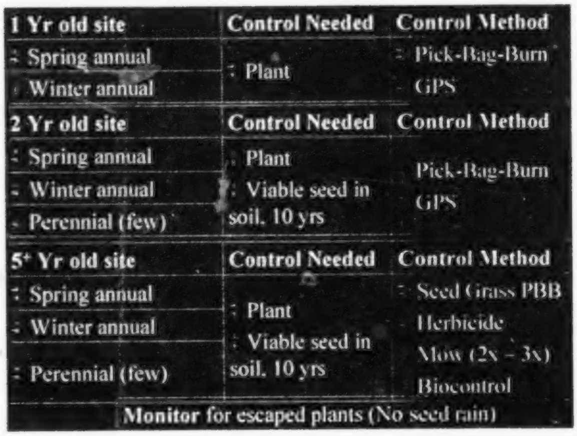
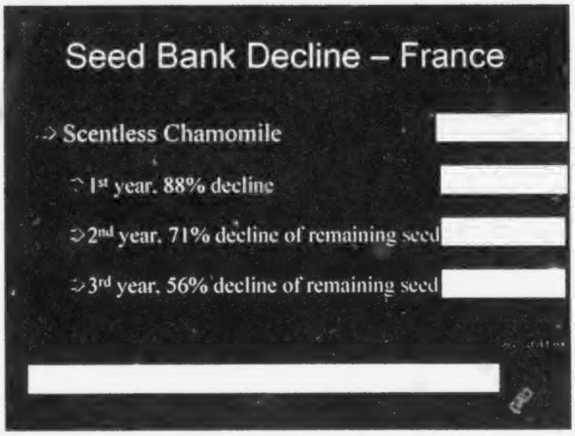
Control (kill) the SC plant	Pick-Bag-Burn Escort Transline Tordon 22K
Kill seed in soil	Can't do

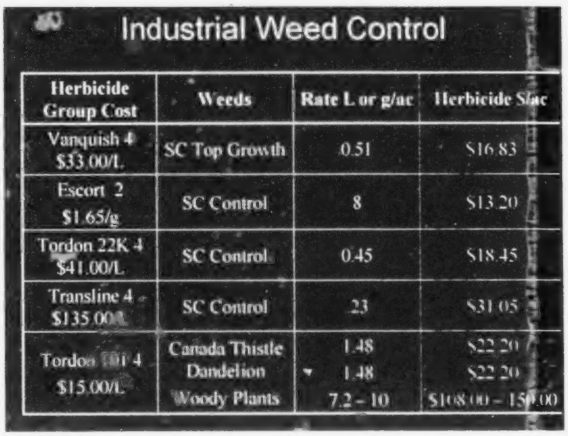


1 Yr old site	Control Needed	Control Method
Spring annual Winter annual	Plant	Pick-Bag-Burn GPS
2 Yr old site	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil. 10 yrs	Pick-Bag-Burn GPS
5⁺ Yr old site	**Control Needed**	**Control Method**
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil. 10 yrs	Seed Grass PBB Herbicide Mow (2x – 3x) Biocontrol
Monitor for escaped plants (No seed rain)		



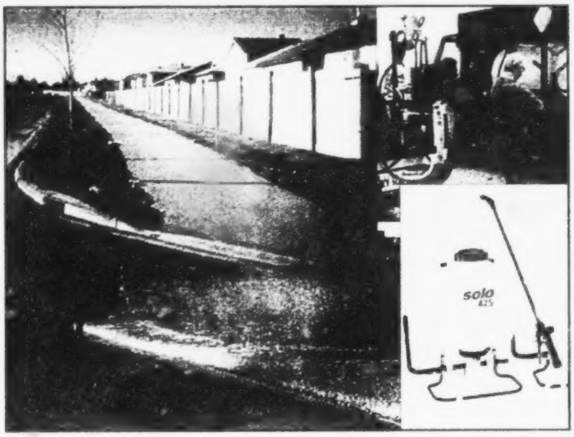
Seed Bank Decline – France

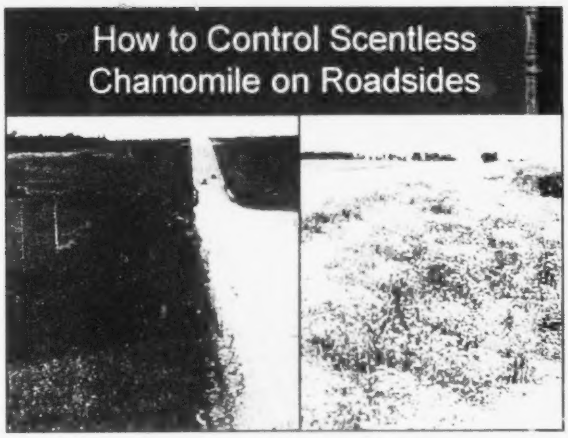
- Scentless Chamomile
  - 1st year, 88% decline
  - 2nd year, 71% decline of remaining seed
  - 3rd year, 56% decline of remaining seed



Industrial Weed Control

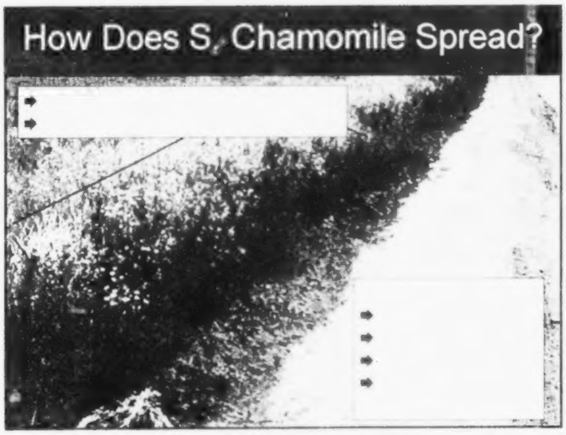
Herbicide Group Cost	Weeds	Rate L or g/ac	Herbicide $/ac
Vanquish 4 $33.00/L	SC Top Growth	0.51	$16.83
Escort 2 $1.65/g	SC Control	8	$13.20
Tordon 22K 4 $41.00/L	SC Control	0.45	$18.45
Transline 4 $135.00	SC Control	23	$31.05
Tordon [illegible] 4 $15.00/L	Canada Thistle Dandelion Woody Plants	1.48 1.48 7.2 – 10	$22.20 $22.20 $108.00 – 150.00



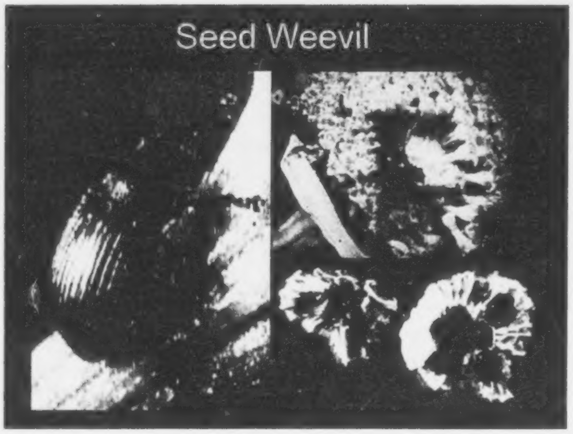


How to Control Scentless Chamomile on Roadsides

Is Competition Perfect?



How Does S. Chamomile Spread?



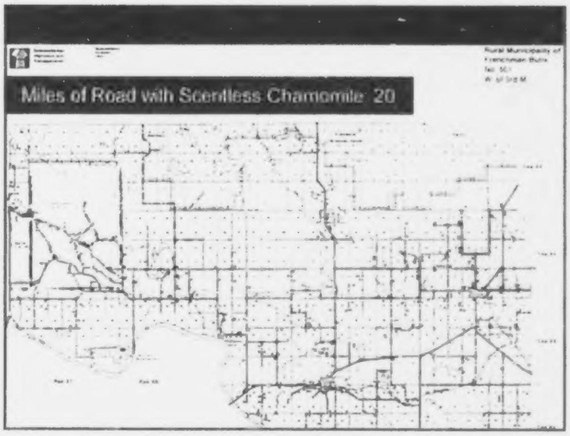
Seed Weevil

Scentless Chamomile Gall Midge

Rhopalomyia tripleurospermi

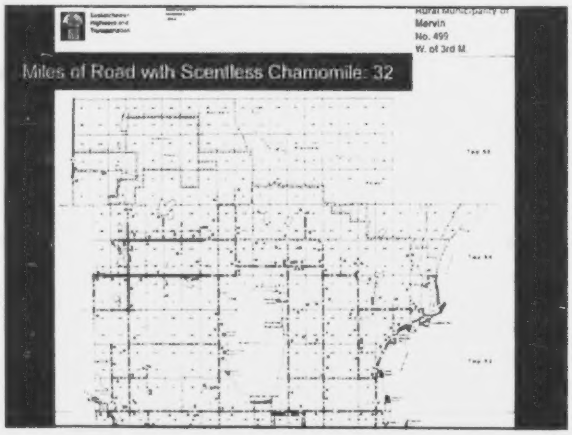
- Galls on plants
  - Shoot tips
  - Leaf axils
  - Rosettes
  - Flowers

Gall Midge *Rhopalomyia tripleurospermi*



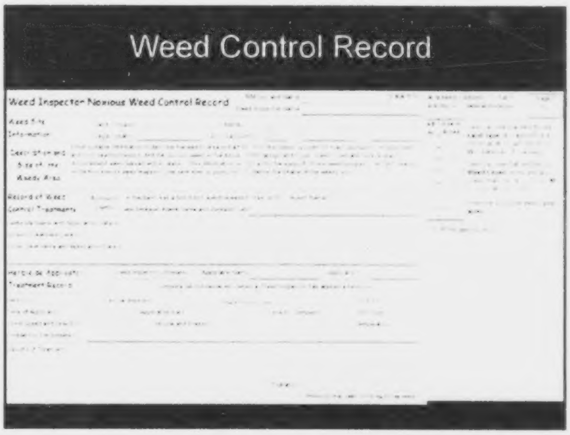
Rural Municipality of
Frenchman Butte
No. 501
W. of 3rd M.

Miles of Road with Scentless Chamomile: 20



Rural Municipality of
Mervin
No. 499
W. of 3rd M.

Miles of Road with Scentless Chamomile: 32



Weed Control Record

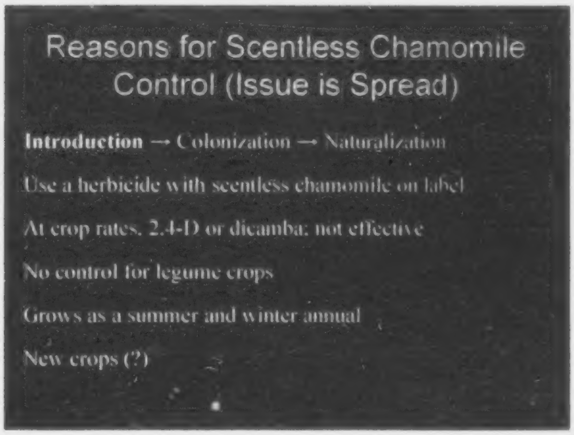
Weed Inspector Noxious Weed Control Record

Weed Site Information

Description and Size of the Weedy Area

Record of Weed Control Treatments

Herbicide Application Treatment Record



Reasons for Scentless Chamomile Control (Issue is Spread)

Introduction → Colonization → Naturalization

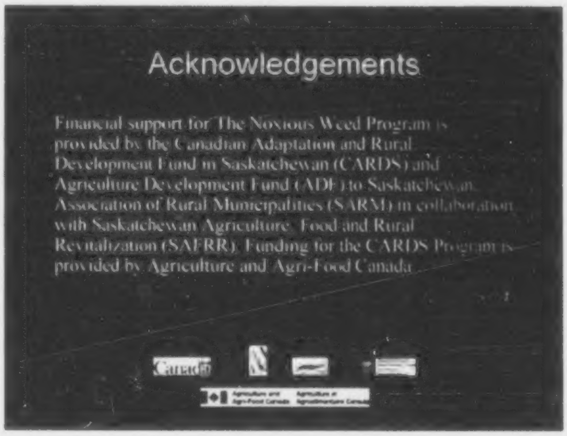
Use a herbicide with scentless chamomile on label

At crop rates, 2,4-D or dicamba: not effective

No control for legume crops

Grows as a summer and winter annual

New crops (?)



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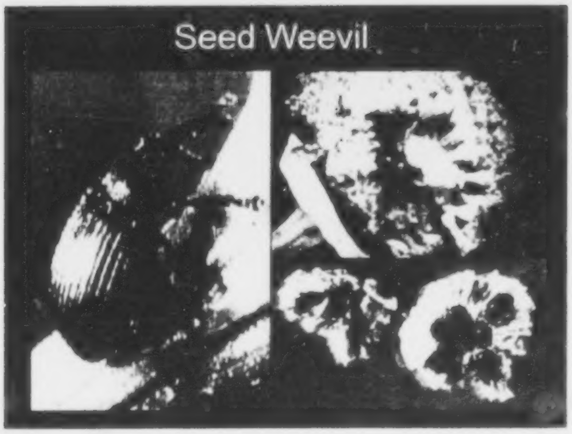


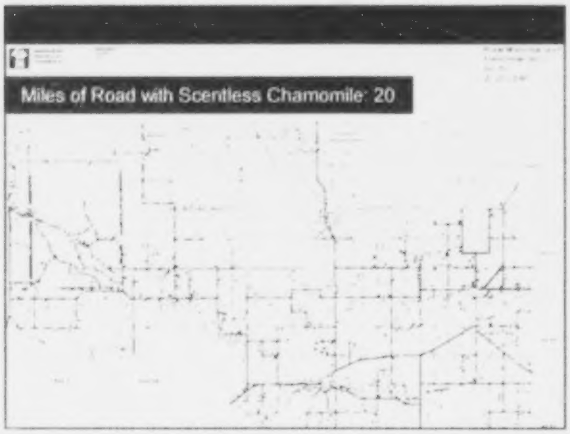
Seed Weevil

Scentless Chamomile Gall Midge

Rhopalomyia tripleurospermi

Galls on plants
- Shoot tips
- Leaf axils
- Rosettes
- Flowers

Gall Midge *Rhopalomyia tripleurospermi*



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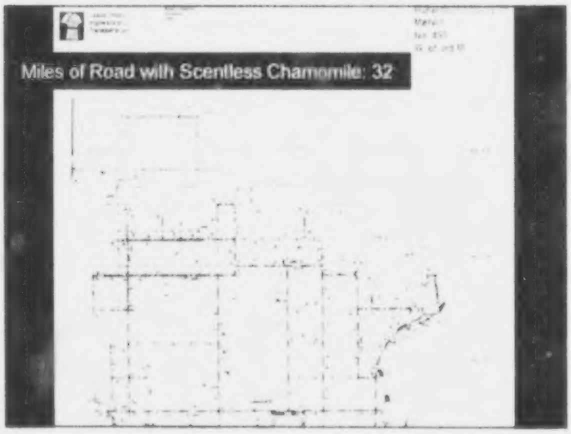
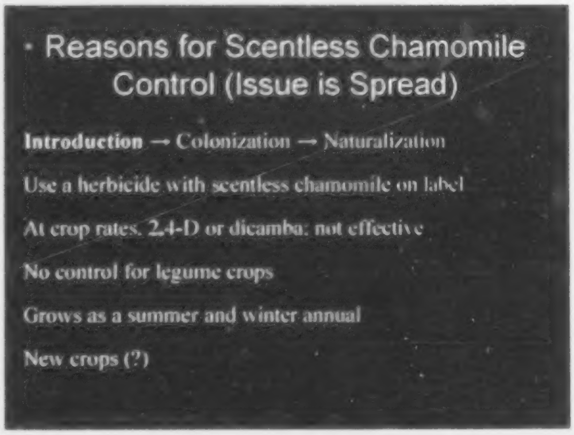


Miles of Road with Scentless Chamomile: 32

Weed Control Record



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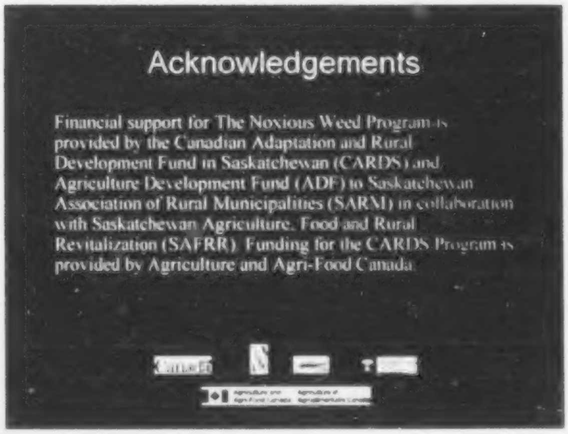

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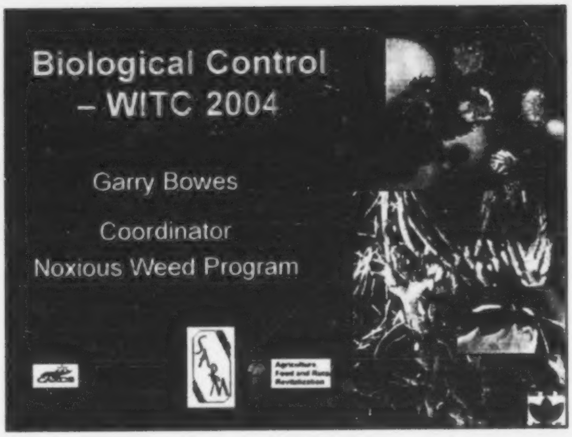
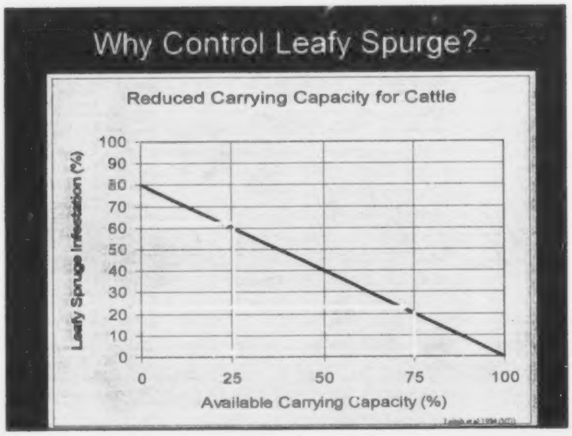


Biological Control – WITC 2004

Garry Bowes

Coordinator

Noxious Weed Program



Why Control Leafy Spurge?

Reduced Carrying Capacity for Cattle

Black Dot Beetle

- *Aphthona nigriscutis*
- Original Colony, 1982
- Spruce Woods Park, MB

Brown Dot Beetle

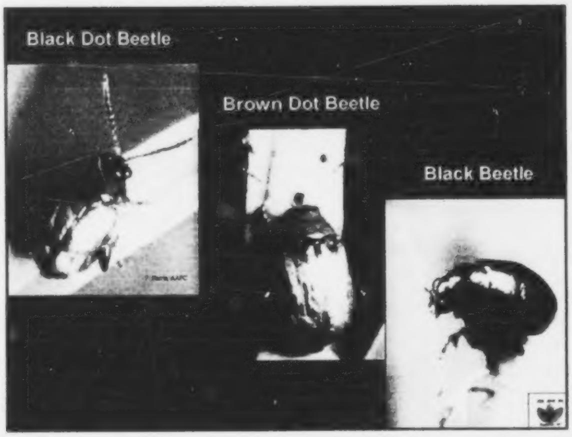
- *Aphthona cyparissiae*
- Original Colony, 1982
- Maxim, SK

Black Beetle

- *Aphthona lacertosa*
- 1990 - 3 Colonies
  - (1 beetle in 1992)
    - RM #99 Caledonia
    - RM #158 Edenwold
    - RM #160 Pense

Leafy Spurge

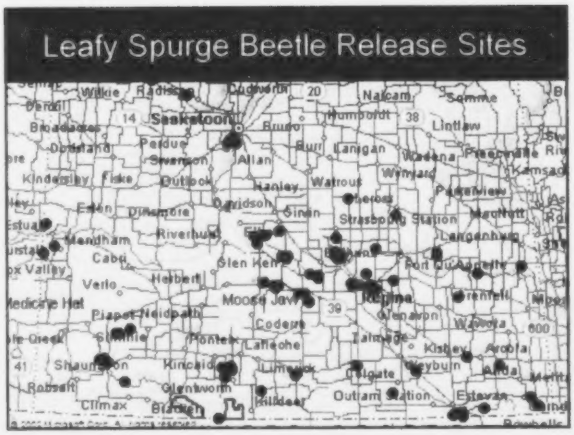
Maxim, SK	
1988	2003
Black Dot	Black Dot
Brown Dot	Brown Dot
	Black



Black Dot Beetle

Brown Dot Beetle

Black Beetle



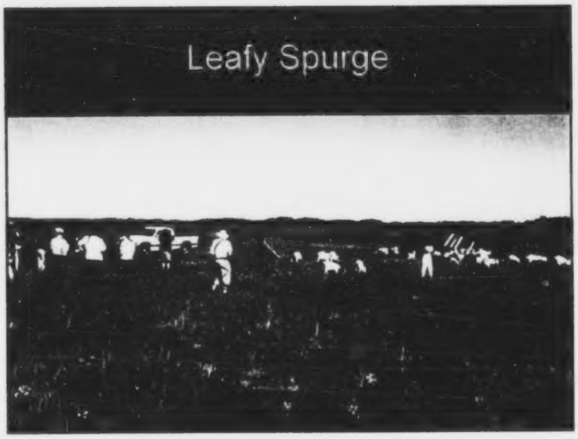
Leafy Spurge Beetle Release Sites

Leafy Spurge

Leafy Spurge Collecting Beetles

Leafy Spurge Collecting Beetles

Leafy Spurge

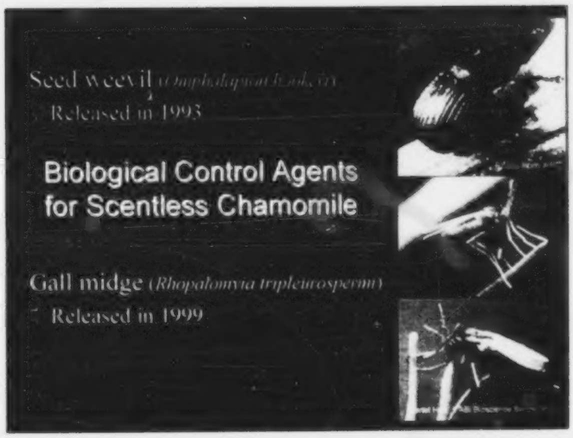


How Effective are Beetles for the Control of Leafy Spurge?

Years After Release	Leafy Spurge Cover (%)	% Grazing Loss	Number of Beetles/ Sweep	Percent of Samples
2 - 16	0	0	1	5%
2 - 16	1 - 10	1 - 13	4	17%
2 - 16	15	19	10	12%
2 - 16	20	25	8	10%
2 - 16	21 - 40	26 - 50	7	[illegible]%
2 - 16	41 - 100	51 - 100	5	31%

Leafy Spurge Natural Enemies. 200? G. Campobasso, N. R. Spencer, G. Terragitti and M. Dolgovskaya. JRM 00:000-000

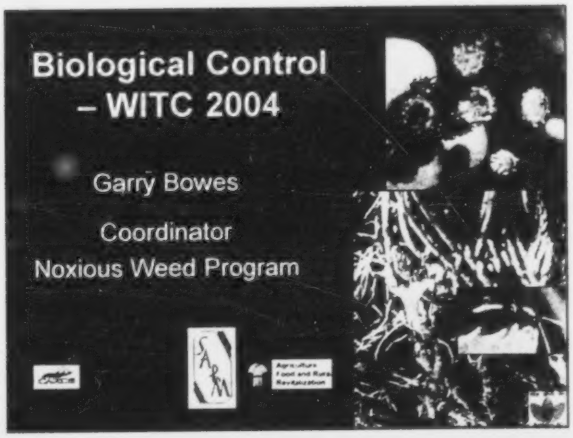
Some leafy spurge will probably escape biological control even as this control increases in areas of North America where the weed has been a bane to ranchers, farmers, environmentalists and land managers. Some leafy spurge infestations, such as those in dry sandy or rocky areas, may not succumb to insect attack because the present group of host specific insect species does best in narrowly defined habitats. Flea beetles in the genus, *Aphthona*, from Russia could extend the control of leafy spurge to new areas of weed infestation, especially in the more northern parts of the United States and across Canada.



Seed weevil (*Omphalapion hookeri*)
- Released in 1993

Biological Control Agents for Scentless Chamomile

Gall midge (*Rhopalomyia tripleurospermi*)
- Released in 1999

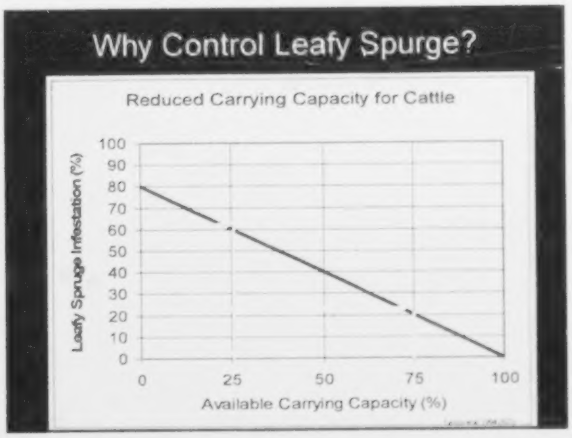


Biological Control – WITC 2004

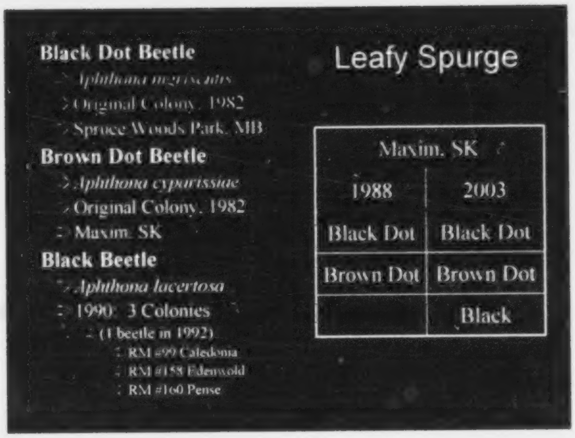
Garry Bowes

Coordinator
Noxious Weed Program

SARM
Agriculture Food and Rural Revitalization



Why Control Leafy Spurge?



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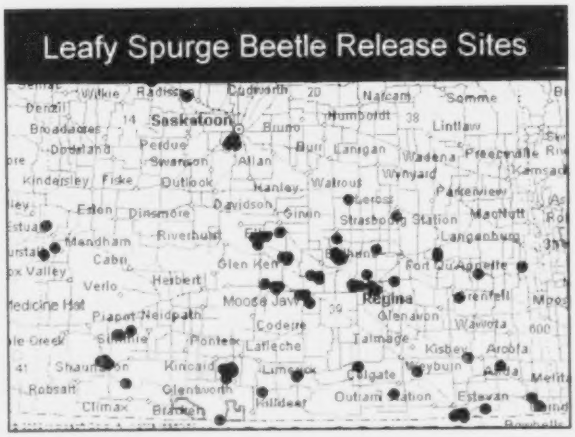

Leafy Spurge Beetle Release Sites

Leafy Spurge

Leafy Spurge Collecting Beetles

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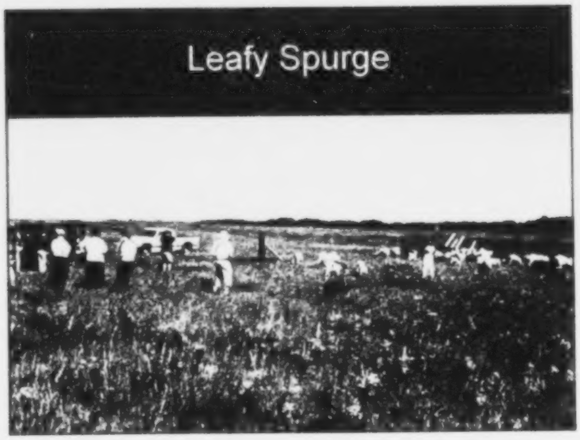
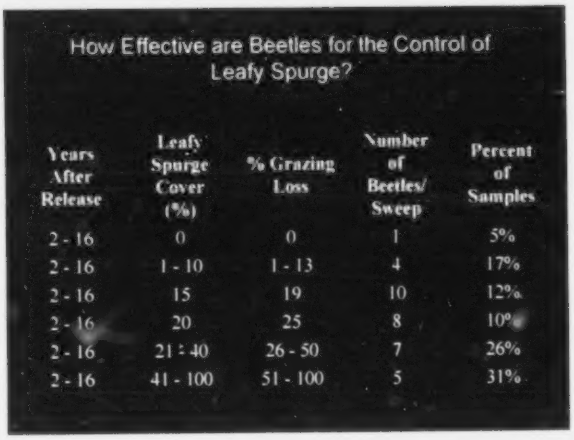


Leafy Spurge



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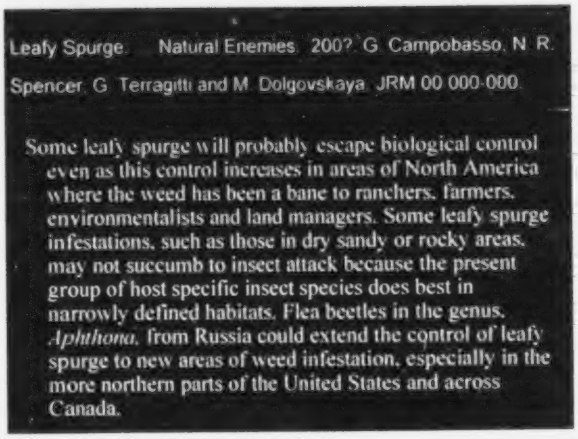

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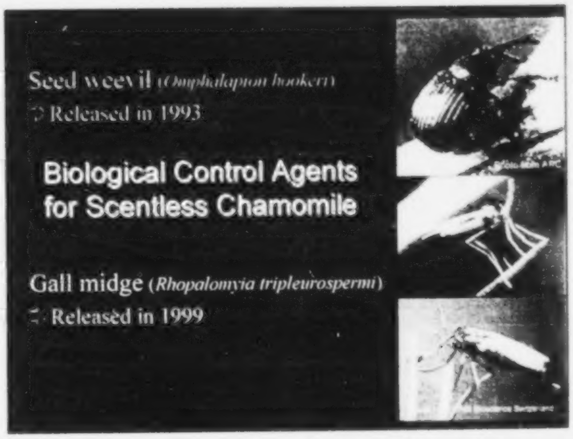

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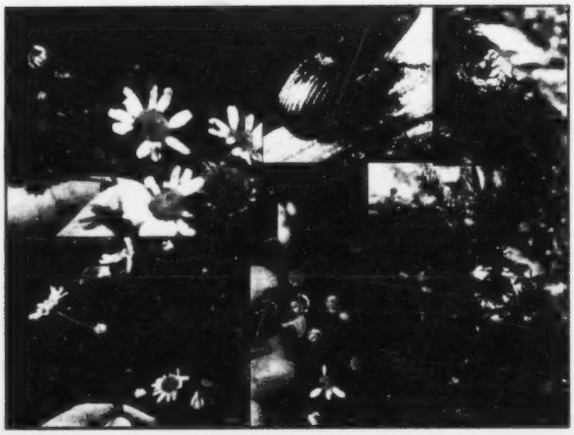
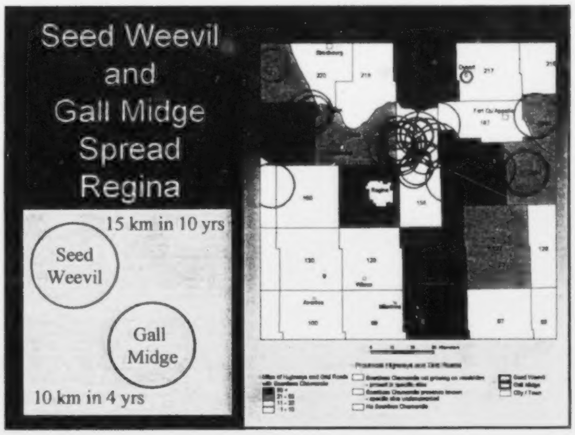




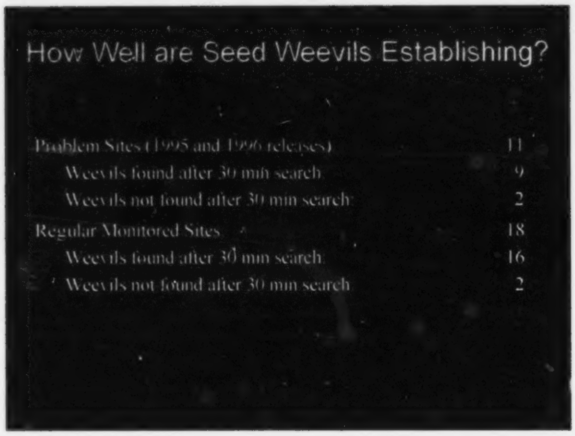
Seed Weevil and Gall Midge Spread Regina

15 km in 10 yrs

Seed Weevil

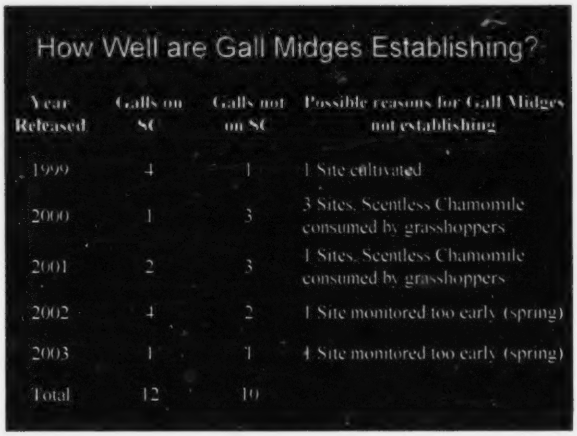
Gall Midge

10 km in 4 yrs



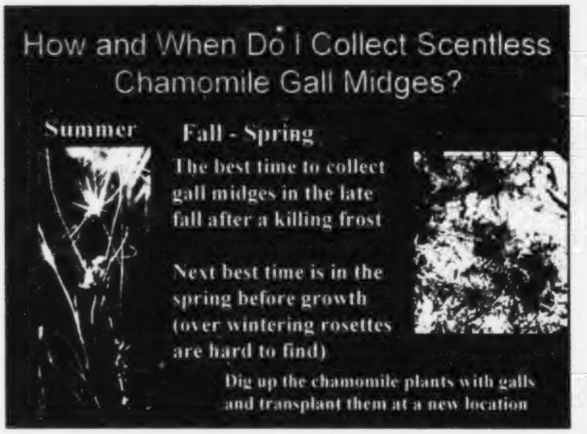
How Well are Seed Weevils Establishing?

Problem Sites (1995 and 1996 releases)	11
Weevils found after 30 min search	9
Weevils not found after 30 min search	2
Regular Monitored Sites	18
Weevils found after 30 min search	16
Weevils not found after 30 min search	2



How Well are Gall Midges Establishing?

Year Released	Galls on SC	Galls not on SC	Possible reasons for Gall Midges not establishing
1999	4	1	1 Site cultivated
2000	1	3	3 Sites. Scentless Chamomile consumed by grasshoppers
2001	2	3	1 Sites. Scentless Chamomile consumed by grasshoppers
2002	4	2	1 Site monitored too early (spring)
2003	1	1	1 Site monitored too early (spring)
Total	12	10	



How and When Do I Collect Scentless Chamomile Gall Midges?

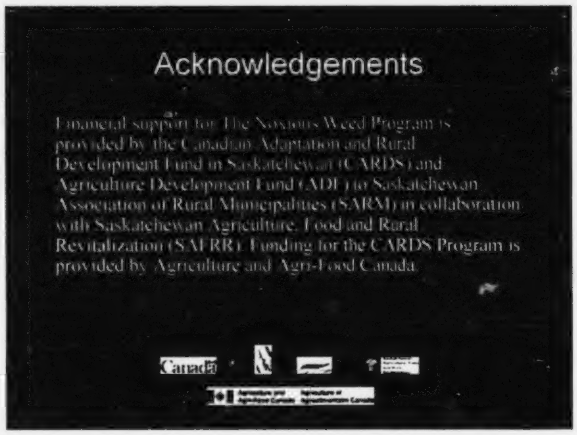
Summer

Fall - Spring

The best time to collect gall midges in the late fall after a killing frost

Next best time is in the spring before growth (over wintering rosettes are hard to find)

Dig up the chamomile plants with galls and transplant them at a new location



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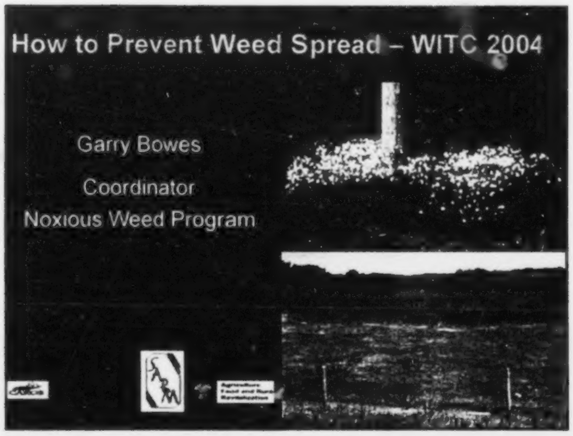
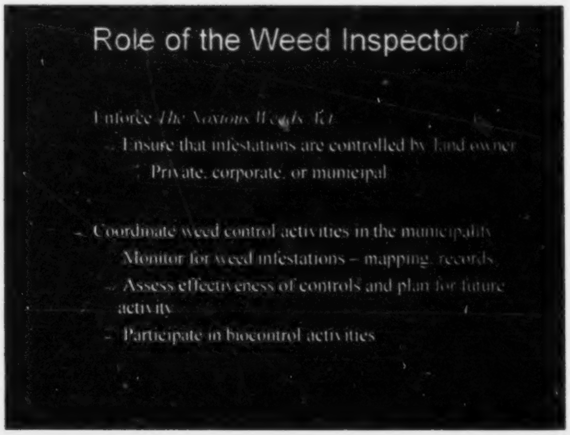


How to Prevent Weed Spread – WITC 2004

Garry Bowes

Coordinator

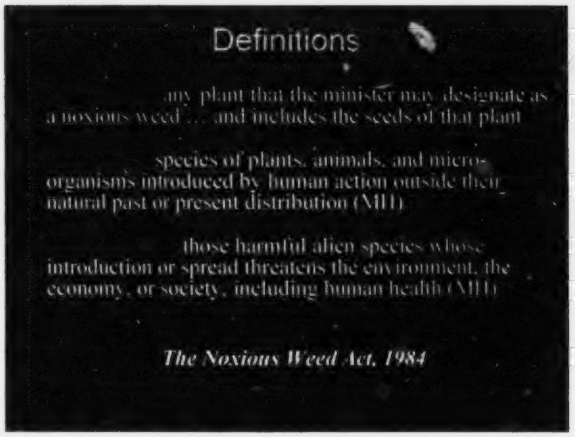
Noxious Weed Program



Role of the Weed Inspector

Enforce *The Noxious Weeds Act*
- Ensure that infestations are controlled by land owner
  - Private, corporate, or municipal

- Coordinate weed control activities in the municipality
  - Monitor for weed infestations – mapping, records
  - Assess effectiveness of controls and plan for future activity
  - Participate in biocontrol activities



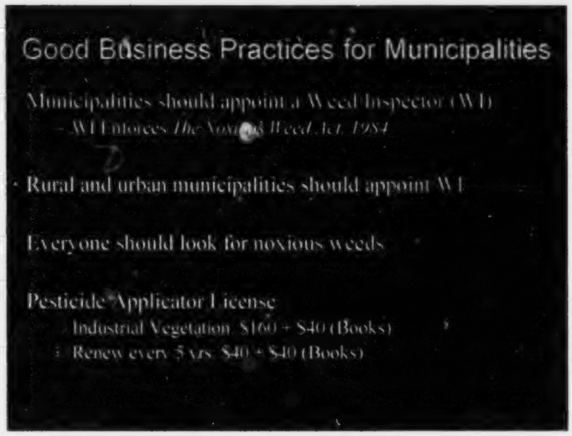
Definitions

any plant that the minister may designate as a noxious weed … and includes the seeds of that plant

species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution (MH)

those harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health (MH)

The Noxious Weed Act, 1984



Good Business Practices for Municipalities

Municipalities should appoint a Weed Inspector (WI)
- WI Enforces *The Noxious Weed Act, 1984*

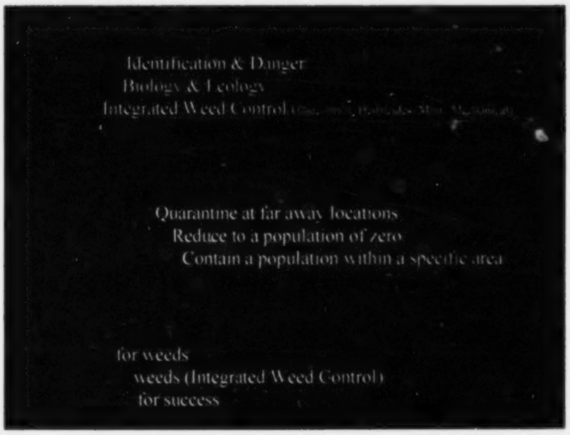
- Rural and urban municipalities should appoint WI

Everyone should look for noxious weeds

Pesticide Applicator License
- Industrial Vegetation $160 + $40 (Books)
- Renew every 5 yrs. $40 + $40 (Books)

SARM Resolutions

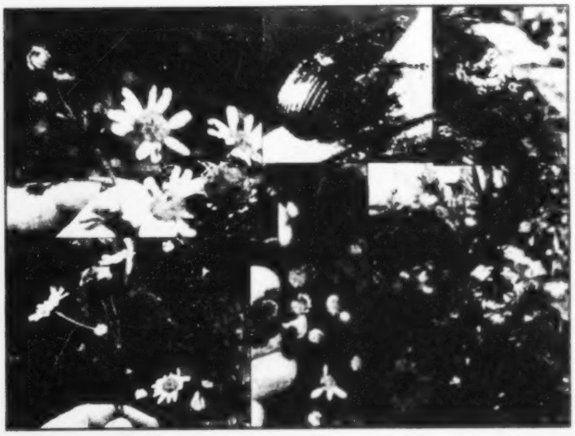
1974, 1975, 1978, 1982, 1986, 1989: Tarpaulin
1978, 1981, 1985, 1988, 1999: Field Bindweed*
1978, 1986, 1996: Scentless Chamomile*
1981, 1982, 1985: Fines, $ Expenditures Limits
1982: Railway ROW
1987: Baby's Breath
1988: Leafy Spurge*
1992, 1994: Downy Brome*
1993: Common Tansy
1998: Japanese Brome*
1999: Weed Inspector Training
1999, 2002: Weed Seeds
* Noxious Weed

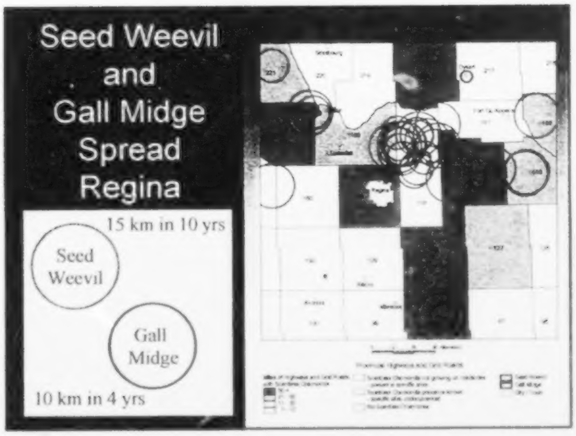


Identification & Danger
Biology & Ecology
Integrated Weed Control [illegible]

Quarantine at far away locations
Reduce to a population of zero
Contain a population within a specific area

for weeds
weeds (Integrated Weed Control)
for success





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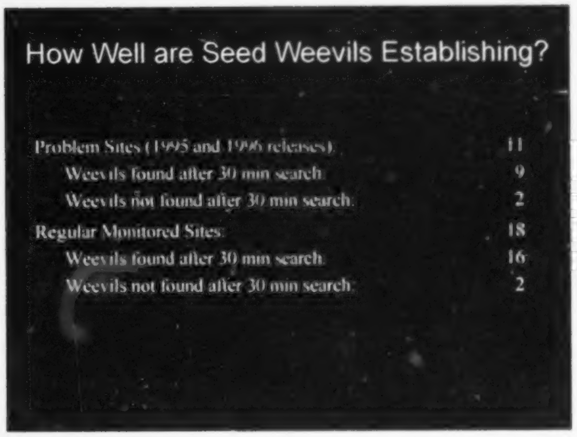
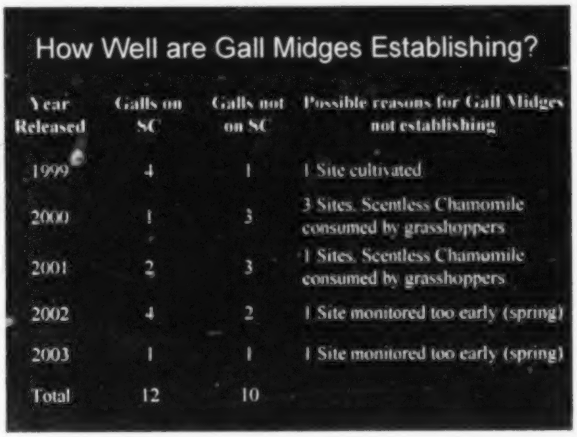
10 km in 4 yrs



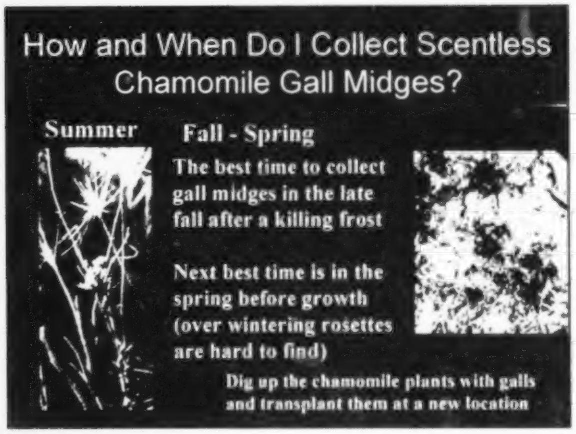
How Well are Seed Weevils Establishing?

Problem Sites (1995 and 1996 releases):	11
Weevils found after 30 min search:	9
Weevils not found after 30 min search:	2
Regular Monitored Sites:	18
Weevils found after 30 min search:	16
Weevils not found after 30 min search:	2



How Well are Gall Midges Establishing?

Year Released	Galls on SC	Galls not on SC	Possible reasons for Gall Midges not establishing
1999	4	1	1 Site cultivated
2000	1	3	3 Sites. Scentless Chamomile consumed by grasshoppers
2001	2	3	1 Sites. Scentless Chamomile consumed by grasshoppers
2002	4	2	1 Site monitored too early (spring)
2003	1	1	1 Site monitored too early (spring)
Total	12	10	



How and When Do I Collect Scentless Chamomile Gall Midges?

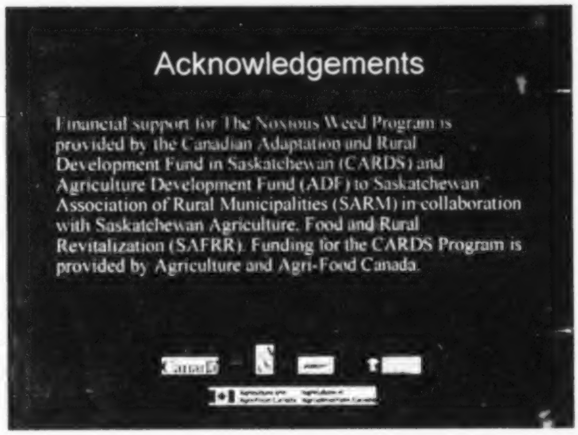
Summer

Fall - Spring

The best time to collect gall midges in the late fall after a killing frost

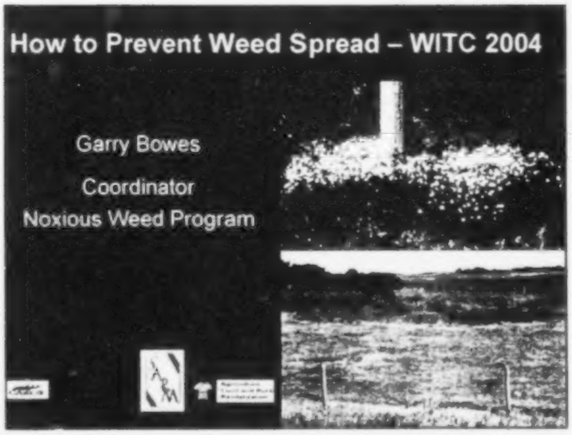
Next best time is in the spring before growth (over wintering rosettes are hard to find)

Dig up the chamomile plants with galls and transplant them at a new location



Acknowledgements

Financial support for The Noxious Weed Program is provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada.

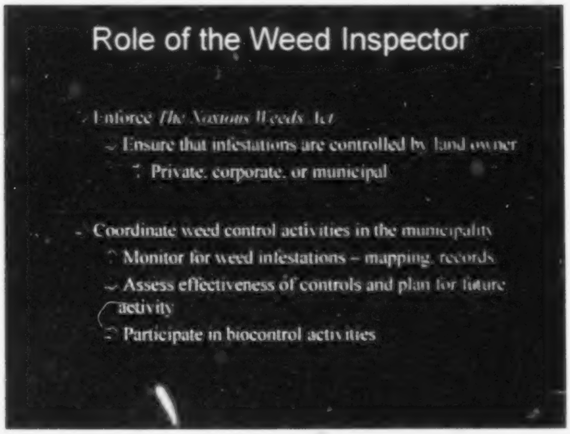


How to Prevent Weed Spread – WITC 2004

Garry Bowes

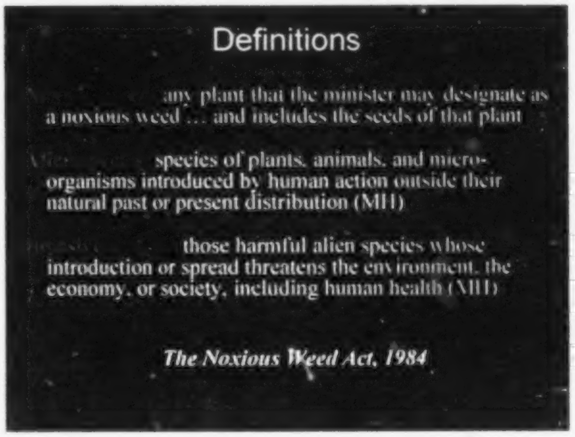
Coordinator

Noxious Weed Program



Role of the Weed Inspector

- Enforce *The Noxious Weeds Act*
  - Ensure that infestations are controlled by land owner
    - Private, corporate, or municipal
- Coordinate weed control activities in the municipality
  - Monitor for weed infestations – mapping, records
  - Assess effectiveness of controls and plan for future activity
  - Participate in biocontrol activities



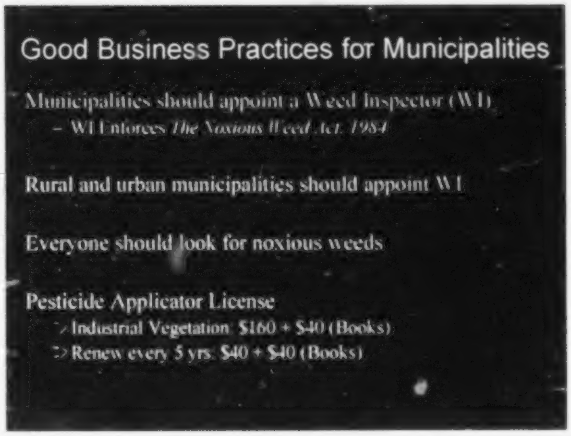
Definitions

any plant that the minister may designate as a noxious weed … and includes the seeds of that plant

species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution (MH)

those harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health (MH)

The Noxious Weed Act, 1984



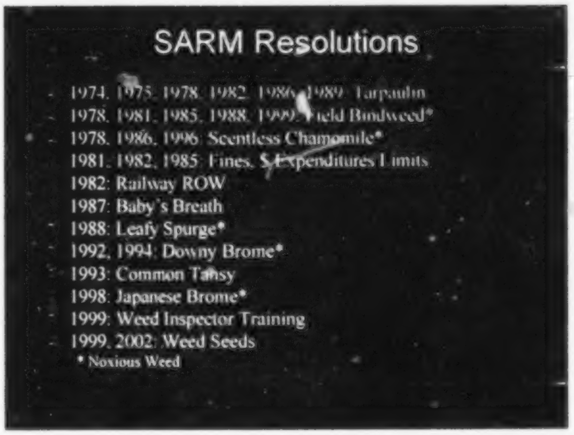
Good Business Practices for Municipalities

Municipalities should appoint a Weed Inspector (WI)
- WI Enforces *The Noxious Weed Act, 1984*

Rural and urban municipalities should appoint WI

Everyone should look for noxious weeds

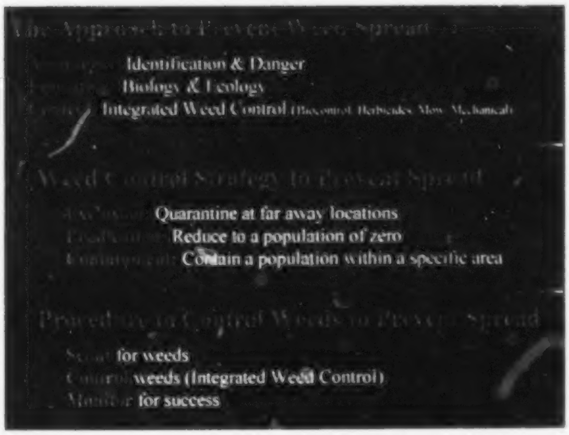
Pesticide Applicator License
- Industrial Vegetation: $160 + $40 (Books)
- Renew every 5 yrs: $40 + $40 (Books)



SARM Resolutions

- 1974, 1975, 1978, 1982, 1986, 1989: Tarpaulin
- 1978, 1981, 1985, 1988, 1999: Field Bindweed*
- 1978, 1986, 1996: Scentless Chamomile*
- 1981, 1982, 1985: Fines, $ Expenditures Limits
- 1982: Railway ROW
- 1987: Baby's Breath
- 1988: Leafy Spurge*
- 1992, 1994: Downy Brome*
- 1993: Common Tansy
- 1998: Japanese Brome*
- 1999: Weed Inspector Training
- 1999, 2002: Weed Seeds

* Noxious Weed



The Approach to Prevent Weed Spread

Identification & Danger

Biology & Ecology

Integrated Weed Control (Biocontrol, Herbicides, Mow, Mechanical)

Weed Control Strategy to Prevent Spread

Prevention: Quarantine at far away locations

Eradication: Reduce to a population of zero

Containment: Contain a population within a specific area

Procedure to Control Weeds to Prevent Spread

Scout for weeds

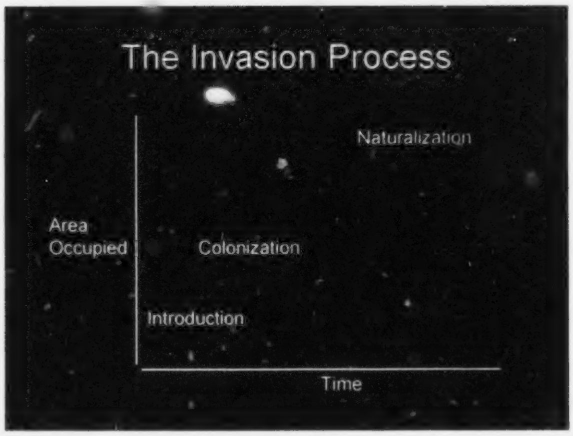
Control weeds (Integrated Weed Control)

Monitor for success

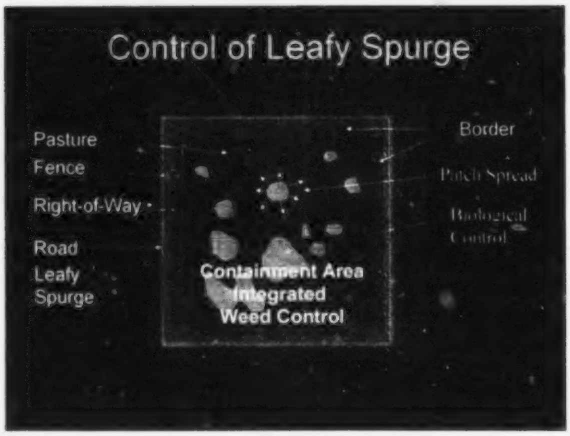
Weed Control Methods

- Manual, Mechanical, Burning
  - Herbicides
  - Insects
  - Plants, Animals
  - Combination of non-conflicting methods

The Invasion Process

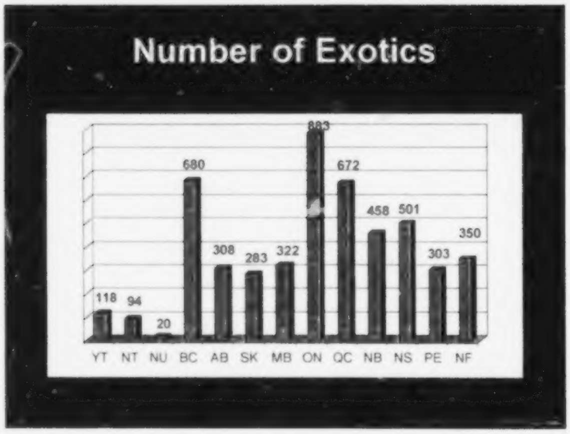


Control of Leafy Spurge

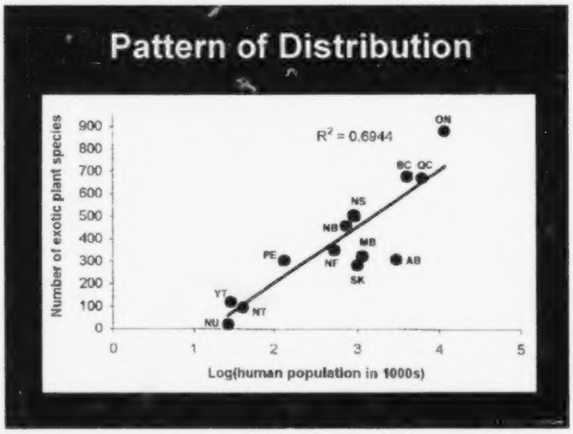


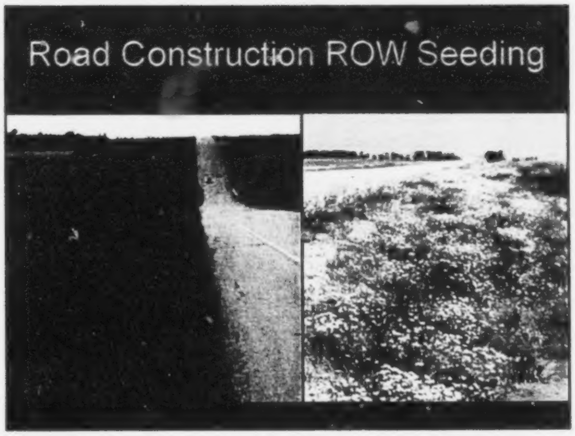
Leafy Spurge Control - Border

Number of Exotics

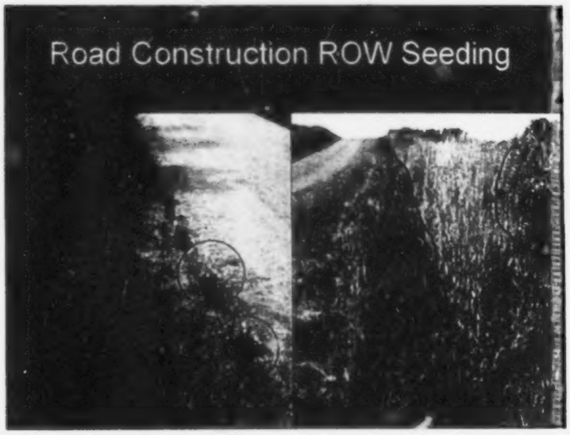


Pattern of Distribution





Road Construction ROW Seeding



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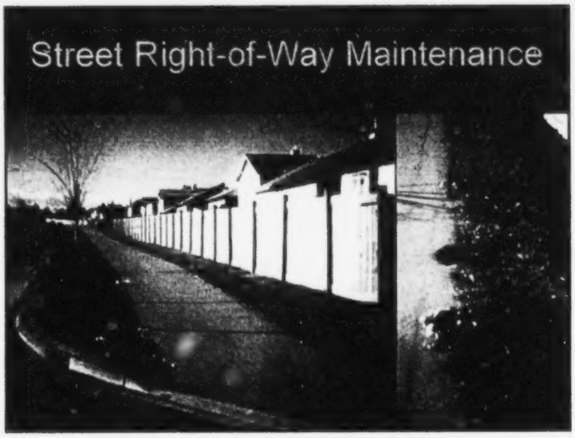
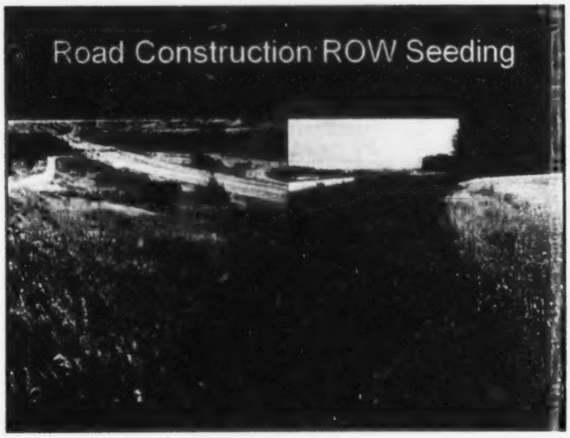


Street Right-of-Way Maintenance



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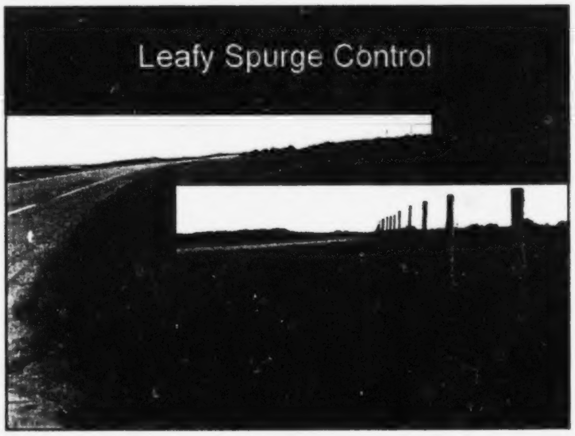
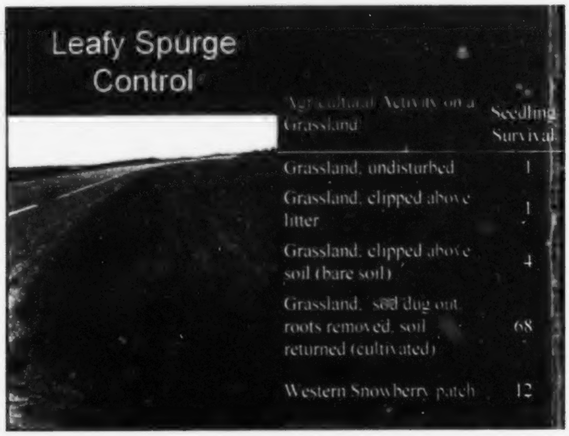
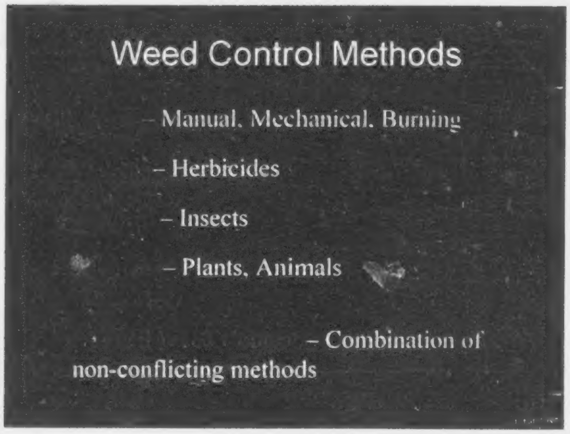


Leafy Spurge Control



Leafy Spurge Control

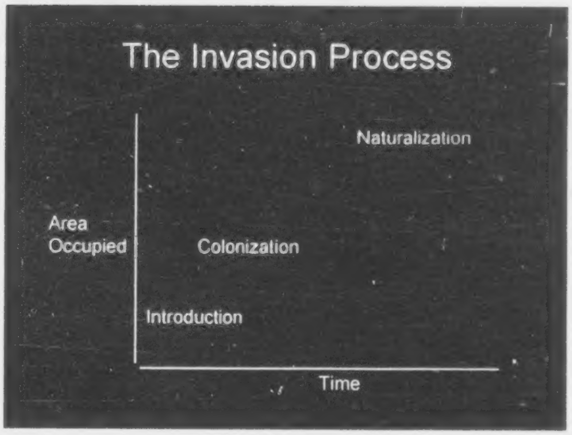
Agricultural Activity on a Grassland	Seedling Survival
Grassland, undisturbed	1
Grassland, clipped above litter	1
Grassland, clipped above soil (bare soil)	4
Grassland, sod dug out, roots removed, soil returned (cultivated)	68
Western Snowberry patch	12



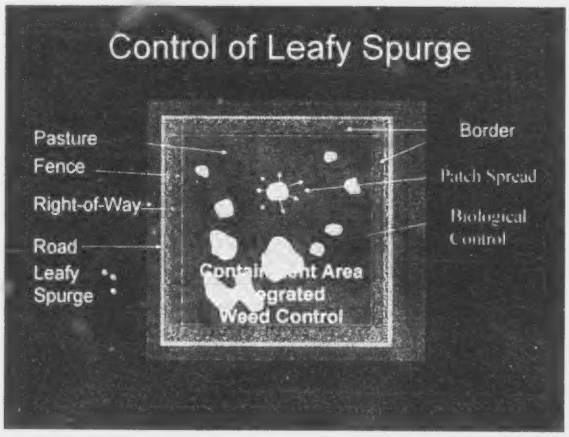
Weed Control Methods

- Manual, Mechanical, Burning
- Herbicides
- Insects
- Plants, Animals

– Combination of non-conflicting methods

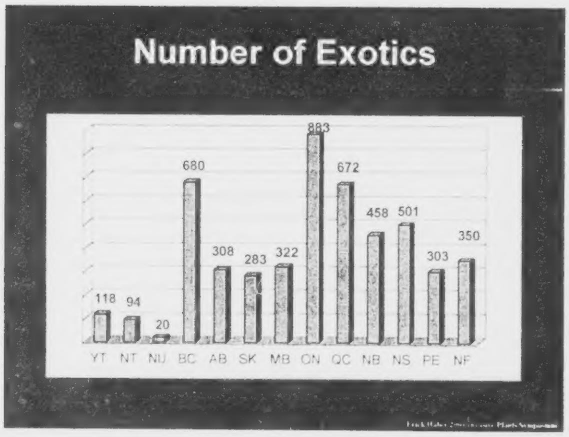


The Invasion Process

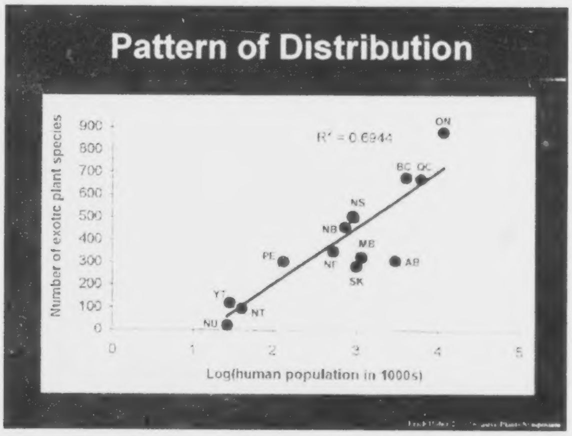


Control of Leafy Spurge

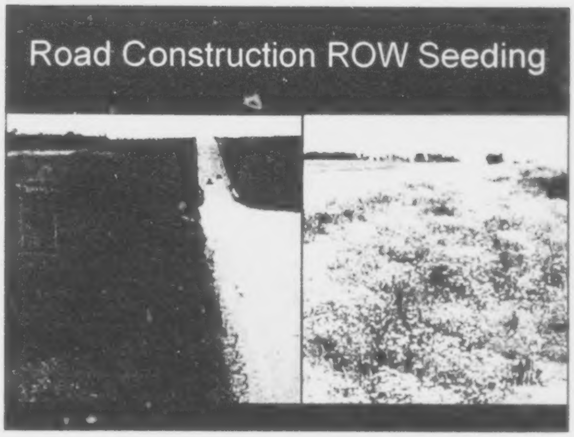
Leafy Spurge Control - Border



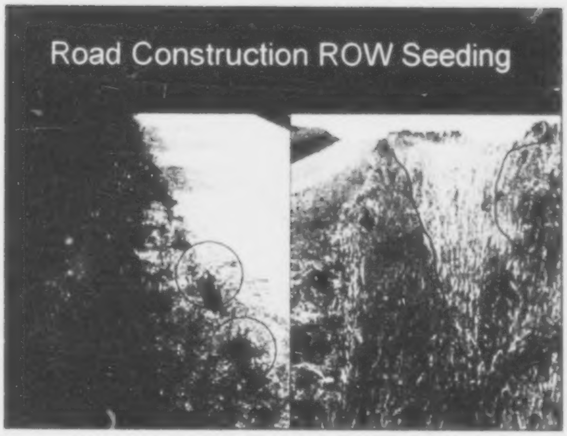
Number of Exotics



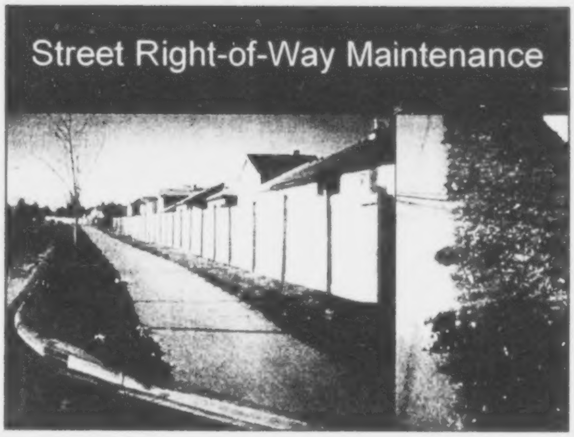
Pattern of Distribution



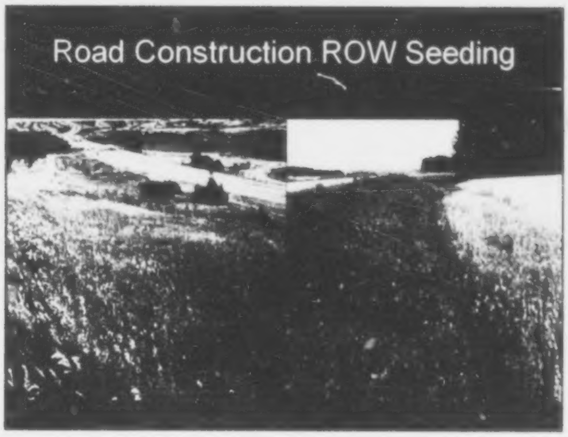
Road Construction ROW Seeding



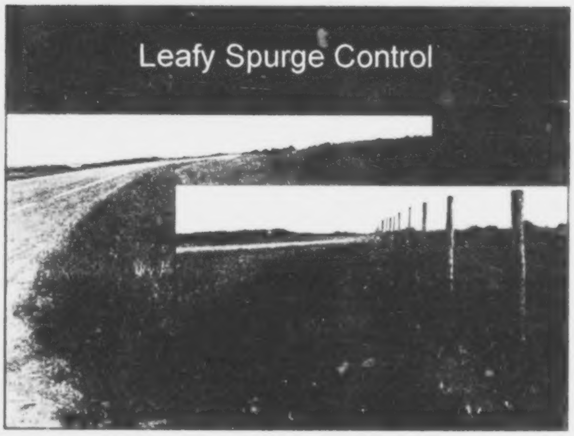
Road Construction ROW Seeding



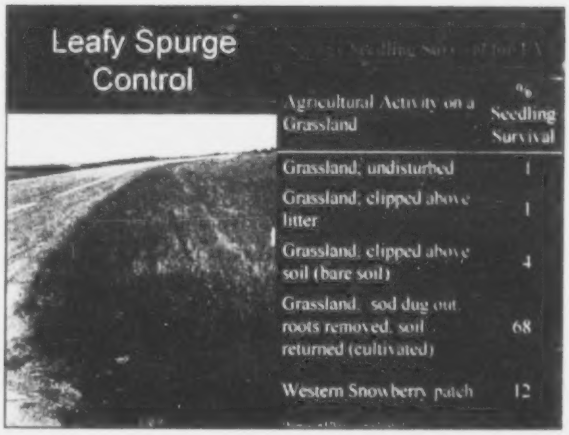
Street Right-of-Way Maintenance



Road Construction ROW Seeding



Leafy Spurge Control



Leafy Spurge Control

[illegible] Seedling [illegible]

Agricultural Activity on a Grassland	% Seedling Survival
Grassland, undisturbed	1
Grassland, clipped above litter	1
Grassland, clipped above soil (bare soil)	4
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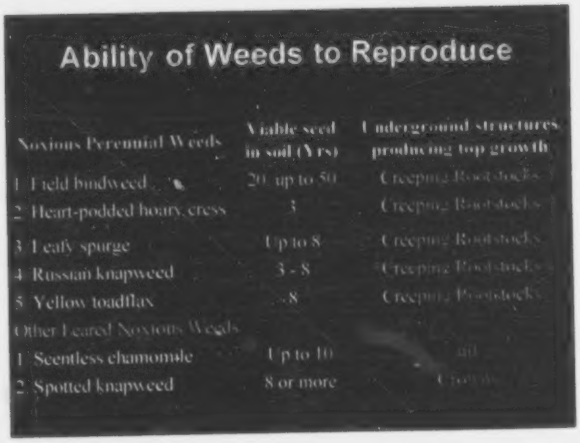
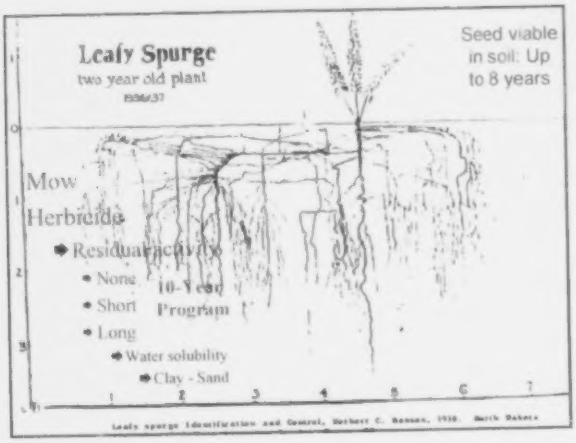


Ability of Weeds to Reproduce

Noxious Perennial Weeds	Viable seed in soil (Yrs)	Underground structures producing top growth
1 Field bindweed	20, up to 50	Creeping Rootstocks
2 Heart-podded hoary cress	3	Creeping Rootstocks
3 Leafy spurge	Up to 8	Creeping Rootstocks
4 Russian knapweed	3 - 8	Creeping Rootstocks
5 Yellow toadflax	8	Creeping Rootstocks
Other Leafed Noxious Weeds		
1 Scentless chamomile	Up to 10	nil
2 Spotted knapweed	8 or more	Crown



Seed viable in soil: Up to 8 years

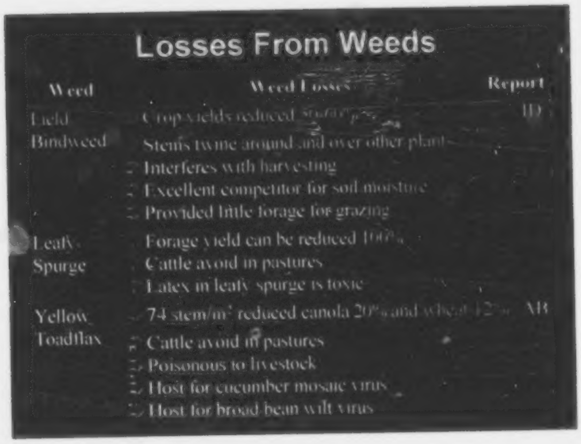
Mow

Herbicide

- Residual activity
  - None
  - Short
  - Long
    - Water solubility
      - Clay - Sand

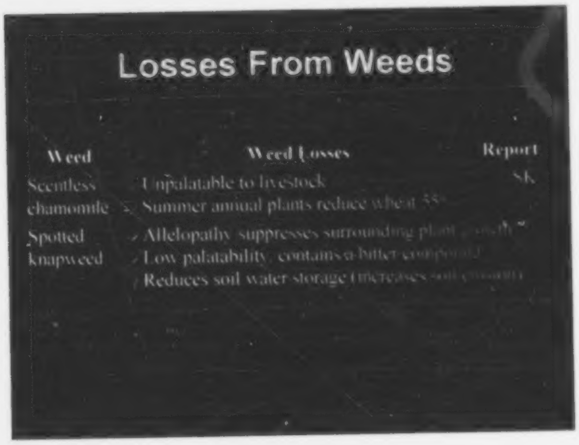
10-Year Program

Leafy spurge Identification and Control, Herbert C. Hanson, 1938. North Dakota



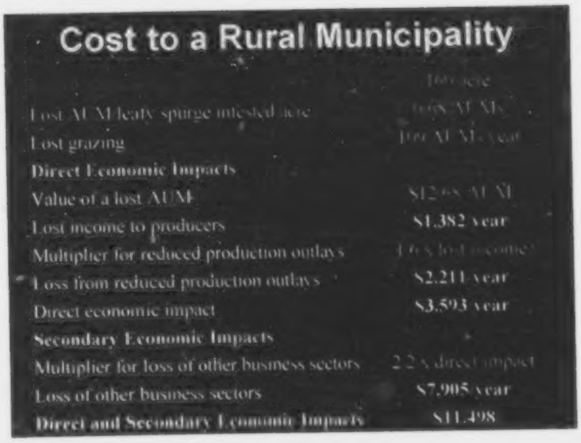
Losses From Weeds

Weed	Weed Losses	Report
Field Bindweed	Crop yields reduced [illegible] Stems twine around and over other plants Interferes with harvesting Excellent competitor for soil moisture Provided little forage for grazing	ID
Leafy Spurge	Forage yield can be reduced 100% Cattle avoid in pastures Latex in leafy spurge is toxic	
Yellow Toadflax	74 stem/m² reduced canola 20% and wheat 12% Cattle avoid in pastures Poisonous to livestock Host for cucumber mosaic virus Host for broad bean wilt virus	AB



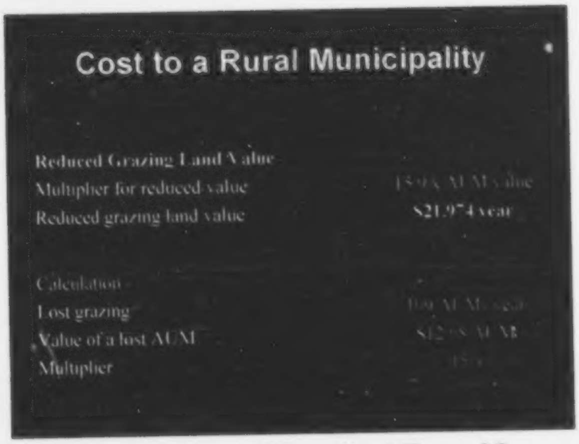
Losses From Weeds

Weed	Weed Losses	Report
Scentless chamomile	Unpalatable to livestock Summer annual plants reduce wheat 55%	SK
Spotted knapweed	Allelopathy suppresses surrounding plant growth Low palatability; contains a bitter compound Reduces soil water storage (increases soil erosion)	



Cost to a Rural Municipality

	160 acre
Lost AUM/leafy spurge infested acre	0.68 AUMs
Lost grazing	109 AUMs/year
Direct Economic Impacts	
Value of a lost AUM	$12.68/AUM
Lost income to producers	$1,382/year
Multiplier for reduced production outlays	1.6 x lost income
Loss from reduced production outlays	$2,211/year
Direct economic impact	$3,593/year
Secondary Economic Impacts	
Multiplier for loss of other business sectors	2.2 x direct impact
Loss of other business sectors	$7,905/year
Direct and Secondary Economic Impacts	$11,498



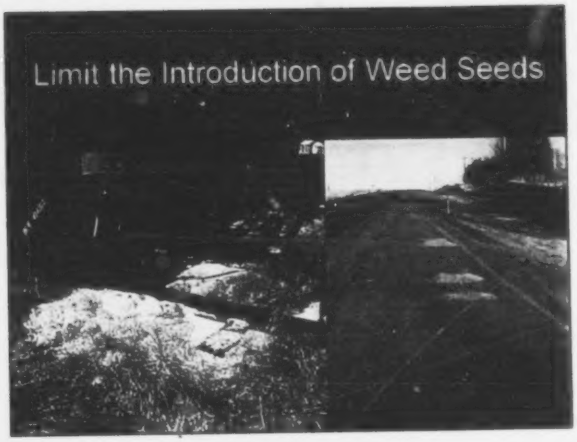
Cost to a Rural Municipality

Reduced Grazing Land Value	
Multiplier for reduced value	15.9 x AUM value
Reduced grazing land value	$21,974/year
Calculation	
Lost grazing	109 AUMs/year
Value of a lost AUM	$12.68/AUM
Multiplier	15.9 x

Plan to Stop Weed Spread

General principles for successful weed prevention plan

- Limit the introduction of weed seeds
- Scout for small patches of weeds and eradication
- Always minimize the disturbance of vegetation
- Manage land to maintain healthy plants
- Look for weeds on high risk areas
- Always seed desirable plants into disturbed sites
- Annually, evaluate the prevention plan



Limit the Introduction of Weed Seeds

Plan to Stop Weed Spread

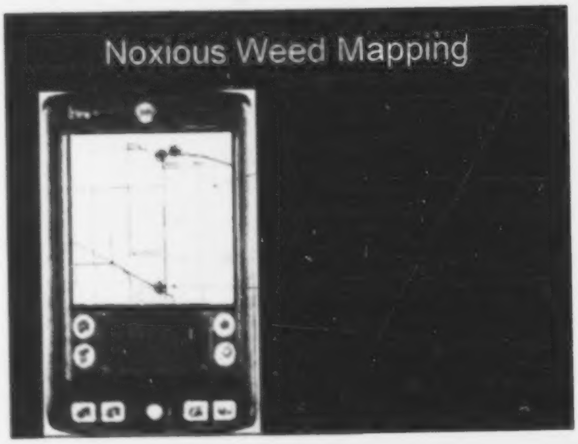
Before a project starts do a weed-risk assessment

- Do an inventory for weeds before starting a project
- Avoid or remove sources of weed seeds
- Plan to control weeds three to five years before vegetation disturbance
- Restrict the movement of equipment from weed-contaminated areas
- Locate and use weed free sites for project staging areas
- Require all equipment to be cleaned free of weeds
- Clean all equipment in the designated site before leaving a project site
- Properly dispose of weed seeds and plant parts by collecting, bagging and incinerating

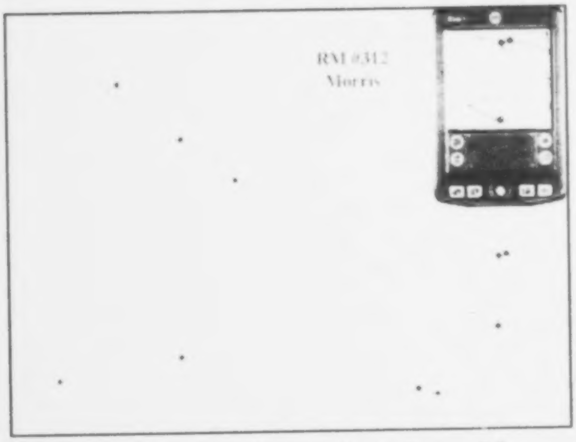
Plan to Stop Weed Spread

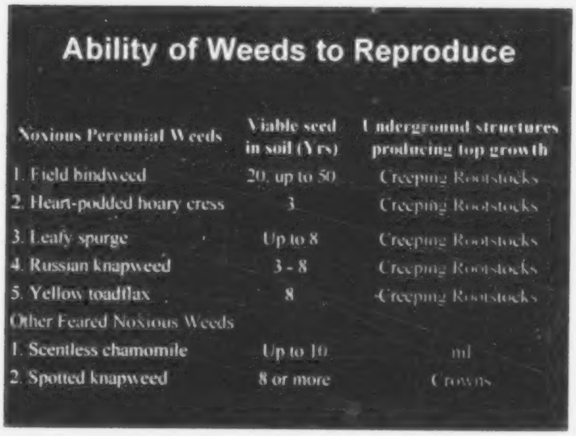
During the operational part of a project, prevent the introduction of new invasive weeds and the spread

- Inspect sites for materials, such as sand, gravel and fill that will be transported and used at the project site
- On sites for materials, which are known to harbour high-risk weeds, strip and stockpile contaminated material before transporting material which is low risk for weeds
- Stockpile non-weed infested material and maintain weed-free for use in areas where high-risk weeds can not be tolerated
- Avoid unnecessary disturbances that leave the ground bare



Noxious Weed Mapping





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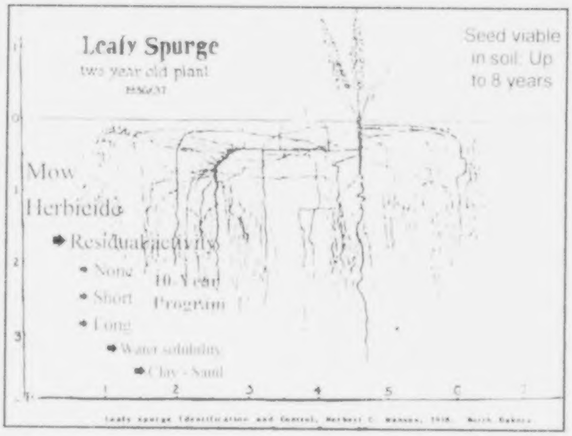
Other Feared Noxious Weeds		
1. Scentless chamomile	Up to 10	nil
2. Spotted knapweed	8 or more	Crowns



Leafy Spurge
two year old plant
1936/37

Seed viable in soil: Up to 8 years

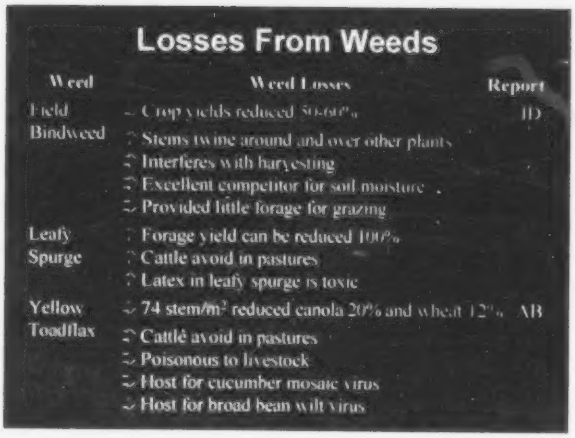
Mow

Herbicide

- Residual activity
  - None
  - Short
  - Long
    - Water solubility
      - Clay - Sand

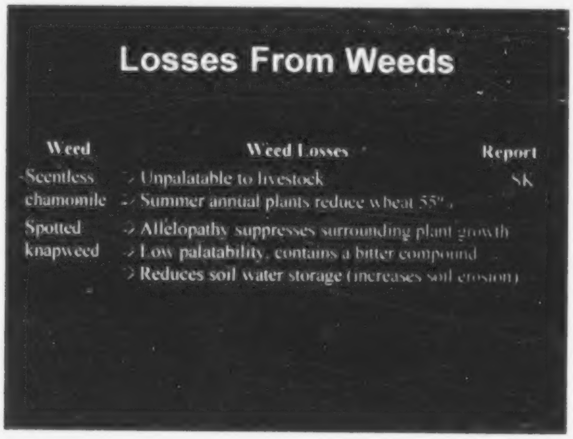
10-Year Program

Leafy Spurge Identification and Control, Herbert C. Hanson, 1938, North Dakota



Losses From Weeds

Weed	Weed Losses	Report
Field Bindweed	Crop yields reduced 50-60%	ID
	Stems twine around and over other plants	
	Interferes with harvesting	
	Excellent competitor for soil moisture	
	Provided little forage for grazing	
Leafy Spurge	Forage yield can be reduced 100%	
	Cattle avoid in pastures	
	Latex in leafy spurge is toxic	
Yellow Toadflax	74 stem/m² reduced canola 20% and wheat 12%	AB
	Cattle avoid in pastures	
	Poisonous to livestock	
	Host for cucumber mosaic virus	
	Host for broad bean wilt virus	



Losses From Weeds

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Scentless chamomile	Unpalatable to livestock	SK
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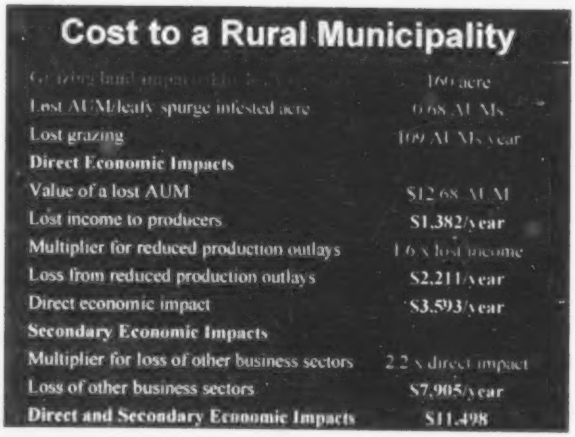
Spotted knapweed	Allelopathy suppresses surrounding plant growth	
	Low palatability, contains a bitter compound	
	Reduces soil water storage (increases soil erosion)	



Cost to a Rural Municipality

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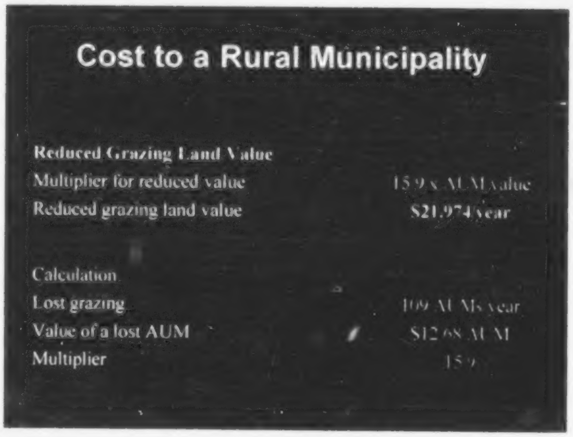

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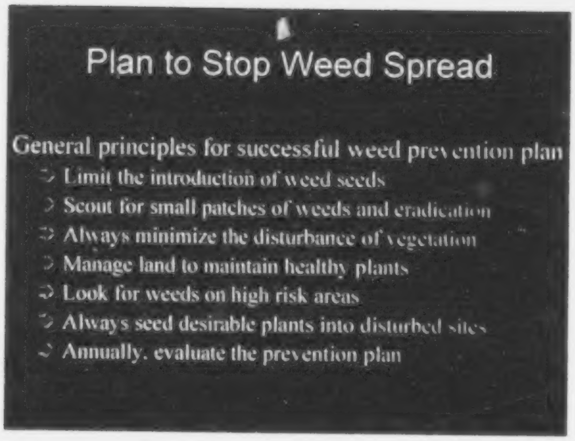
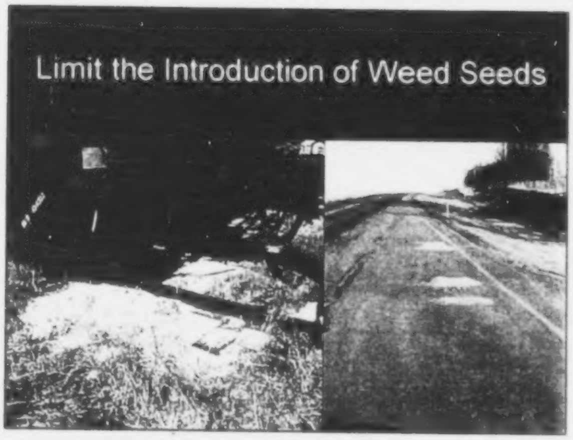
Reduced Grazing Land Value	
Multiplier for reduced value	15.9 x AUM value
Reduced grazing land value	**$21,974/year**
Calculation	
Lost grazing	109 AUMs/year
Value of a lost AUM	$12.68/AUM
Multiplier	15.9



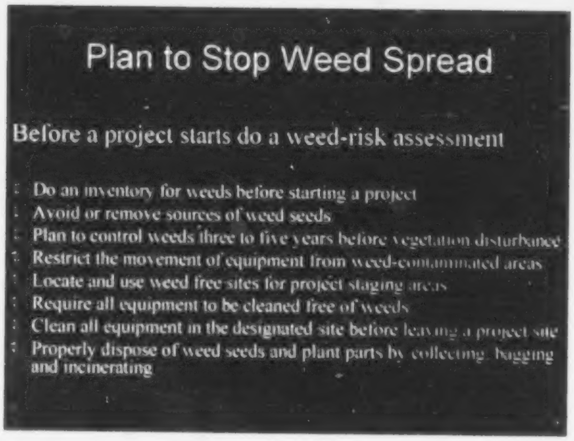
Plan to Stop Weed Spread

General principles for successful weed prevention plan

- Limit the introduction of weed seeds
- Scout for small patches of weeds and eradication
- Always minimize the disturbance of vegetation
- Manage land to maintain healthy plants
- Look for weeds on high risk areas
- Always seed desirable plants into disturbed sites
- Annually, evaluate the prevention plan



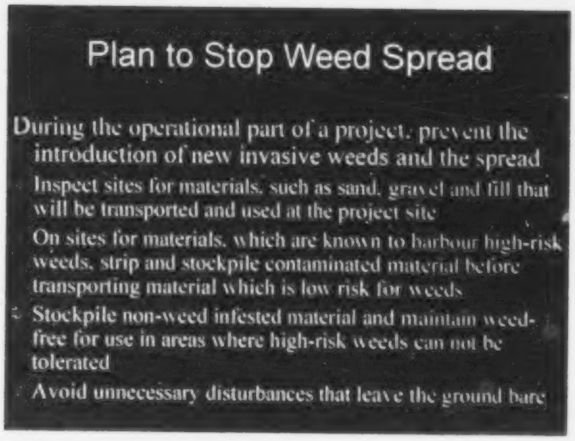
Limit the Introduction of Weed Seeds



Plan to Stop Weed Spread

Before a project starts do a weed-risk assessment

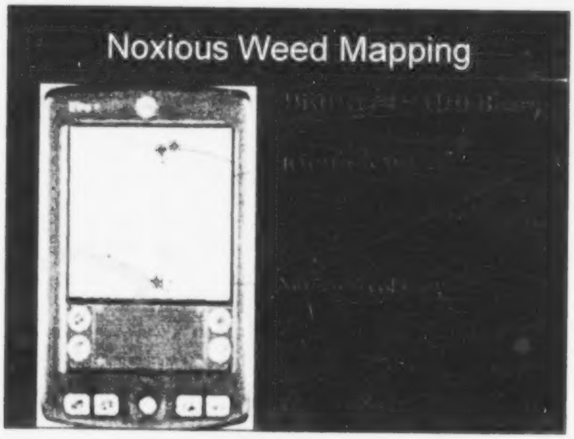
- Do an inventory for weeds before starting a project
- Avoid or remove sources of weed seeds
- Plan to control weeds three to five years before vegetation disturbance
- Restrict the movement of equipment from weed-contaminated areas
- Locate and use weed free sites for project staging areas
- Require all equipment to be cleaned free of weeds
- Clean all equipment in the designated site before leaving a project site
- Properly dispose of weed seeds and plant parts by collecting, bagging and incinerating



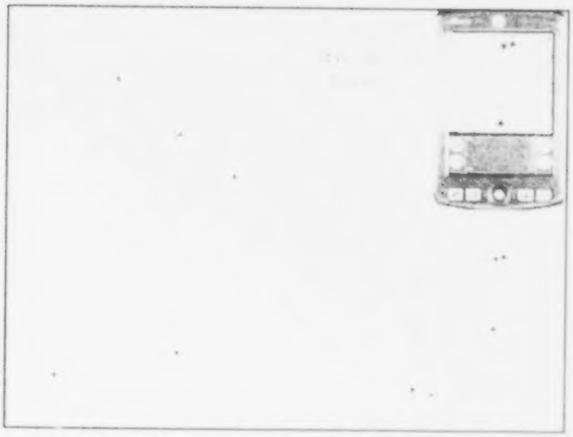
Plan to Stop Weed Spread

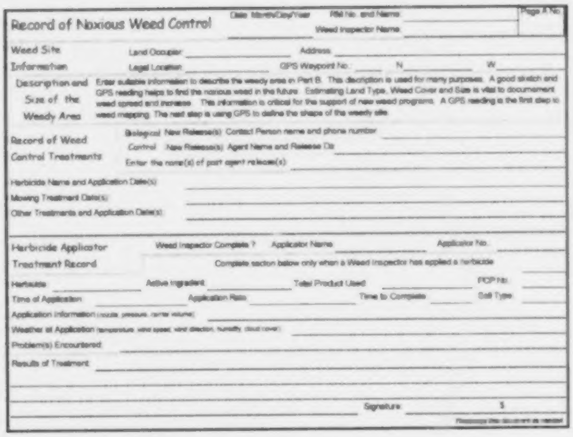
During the operational part of a project, prevent the introduction of new invasive weeds and the spread

- Inspect sites for materials, such as sand, gravel and fill that will be transported and used at the project site
- On sites for materials, which are known to harbour high-risk weeds, strip and stockpile contaminated material before transporting material which is low risk for weeds
- Stockpile non-weed infested material and maintain weed-free for use in areas where high-risk weeds can not be tolerated
- Avoid unnecessary disturbances that leave the ground bare



Noxious Weed Mapping





Record of Noxious Weed Control

Date Month/Day/Year ______ RM No. and Name ______ Page A No.

Weed Inspector Name ______

Weed Site Information

Land Occupier ______ Address ______

Legal Location ______ GPS Waypoint No. ______ N ______ W ______

Description and Size of the Weedy Area

Enter suitable information to describe the weedy area in Part B. This description is used for many purposes. A good sketch and GPS reading helps to find the noxious weed in the future. Estimating Land Type, Weed Cover and Size is vital to document weed spread and increase. This information is critical for the support of new weed programs. A GPS reading is the first step to weed mapping. The next step is using GPS to define the shape of the weedy site.

Record of Weed Control Treatments

Biological Control New Release(s): Contact Person name and phone number ______

New Release(s): Agent Name and Release Dt. ______

Enter the name(s) of past agent release(s) ______

Herbicide Name and Application Date(s) ______

Mowing Treatment Date(s) ______

Other Treatments and Application Date(s) ______

Herbicide Applicator Treatment Record

Weed Inspector Complete ? Applicator Name ______ Applicator No. ______

Complete section below only when a Weed Inspector has applied a herbicide

Herbicide ______ Active Ingredient ______ Total Product Used ______ PCP No. ______

Time of Application ______ Application Rate ______ Time to Complete ______ Soil Type ______

Application Information (nozzle, pressure, carrier volume) ______

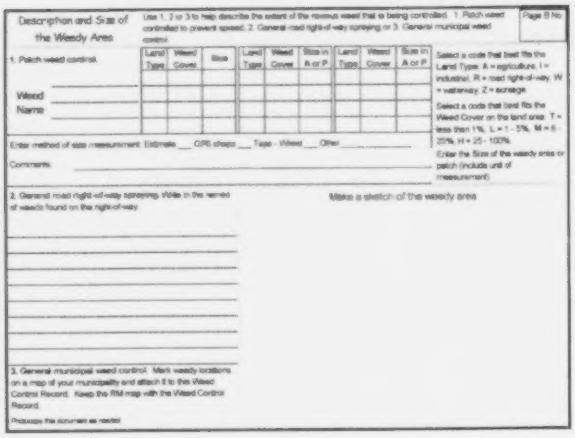
Weather at Application (temperature, wind speed, wind direction, humidity, cloud cover) ______

Problem(s) Encountered ______

Results of Treatment ______

Signature ______ $

Photocopy this document as needed



Description and Size of the Weedy Area

Use 1, 2 or 3 to help describe the extent of the noxious weed that is being controlled. 1. Patch weed controlled to prevent spread. 2. General road right-of-way spraying or 3. General municipal weed control.

Page B No.

1. Patch weed control.

Weed Name

Land Type	Weed Cover	Size	Land Type	Weed Cover	Size in A or P	Land Type	Weed Cover	Size in A or P

Select a code that best fits the Land Type: A = agriculture, I = industrial, R = road right-of-way, W = waterway, Z = acreage

Select a code that best fits the Weed Cover on the land area: T = less than 1%, L = 1 - 5%, M = 6 - 25%, H = 25 - 100%.

Enter the Size of the weedy area or patch (include unit of measurement)

Enter method of size measurement: Estimate __ GPS shape __ Tape - Wheel __ Other ______

Comments ______

2. General road right-of-way spraying. Write in the names of weeds found on the right-of-way.

Make a sketch of the weedy area

3. General municipal weed control. Mark weedy locations on a map of your municipality and attach it to this Weed Control Record. Keep the RM map with the Weed Control Record.

Photocopy this document as needed

Watch List

Identification

Biology & Ecology

Location

Field Bindweed

Leafy Spurge

Yellow Toadflax

Common Tansy

Spotted Knapweed

Wild Parsnip

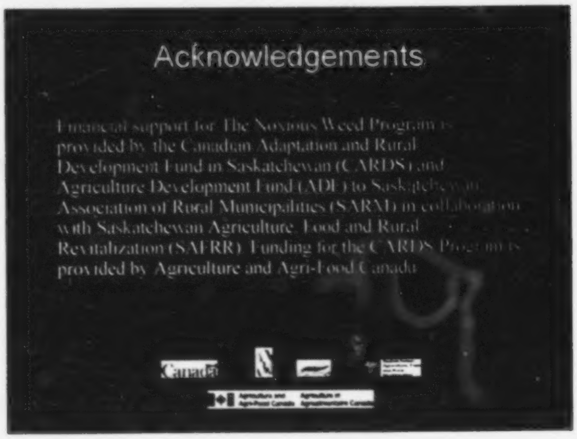
Hoary Alyssum

Wanted Dead

Field Bindweed

Leafy Spurge

Yellow Toadflax



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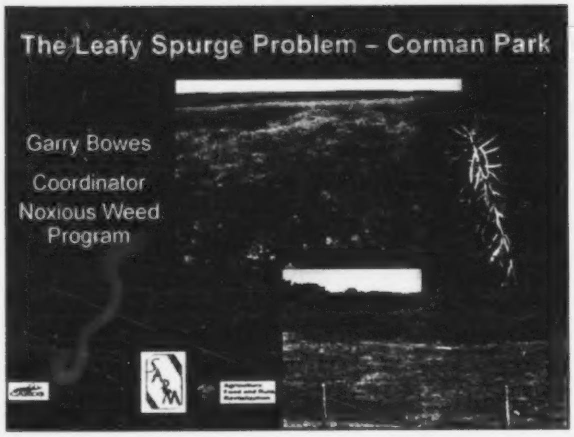
Canada
Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

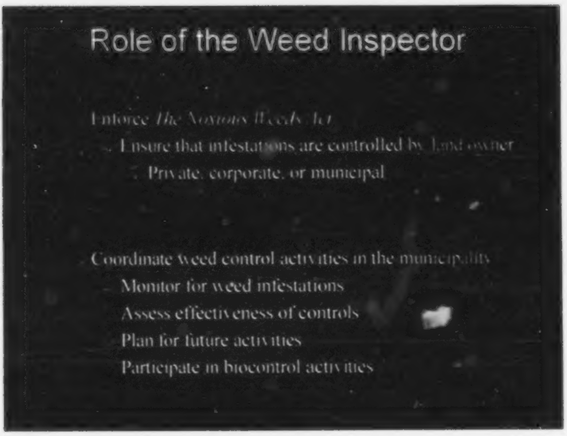


The Leafy Spurge Problem – Corman Park

Garry Bowes

Coordinator

Noxious Weed Program



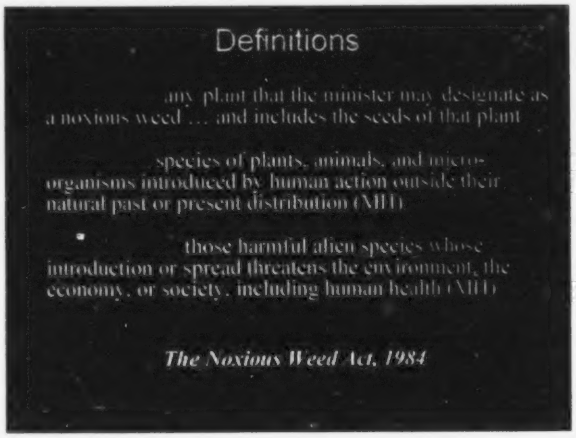
Role of the Weed Inspector

Enforce *The Noxious Weeds Act*

- Ensure that infestations are controlled by land owner
  - Private, corporate, or municipal

Coordinate weed control activities in the municipality

- Monitor for weed infestations
- Assess effectiveness of controls
- Plan for future activities
- Participate in biocontrol activities



Definitions

any plant that the minister may designate as a noxious weed … and includes the seeds of that plant

species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution (MH)

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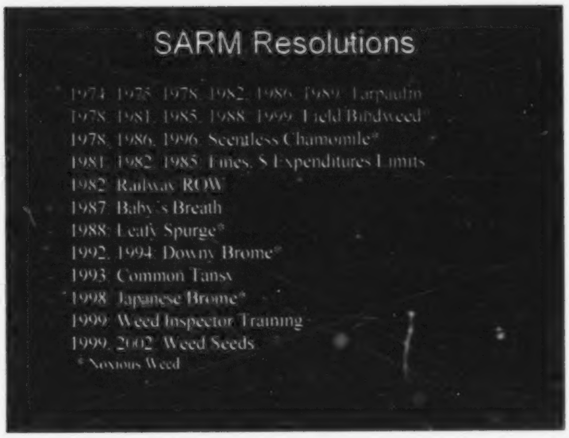
The Noxious Weed Act, 1984



SARM Resolutions

1974, 1975, 1978, 1982, 1986, 1989: Tarpaulin

1978, 1981, 1985, 1988, 1999: Field Bindweed*

1978, 1986, 1996: Scentless Chamomile*

1981, 1982, 1985: Fines, $ Expenditures Limits

1982: Railway ROW

1987: Baby's Breath

1988: Leafy Spurge*

1992, 1994: Downy Brome*

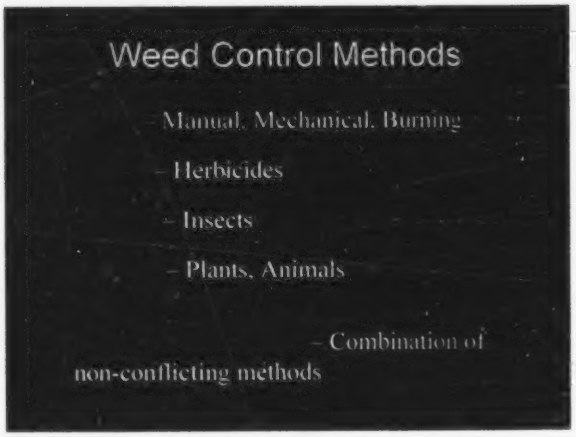
1993: Common Tansy

1998: Japanese Brome*

1999: Weed Inspector Training

1999, 2002: Weed Seeds

* Noxious Weed



Weed Control Methods

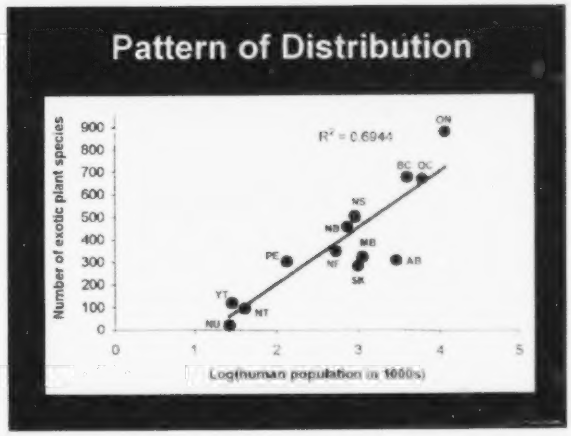
– Manual, Mechanical, Burning

– Herbicides

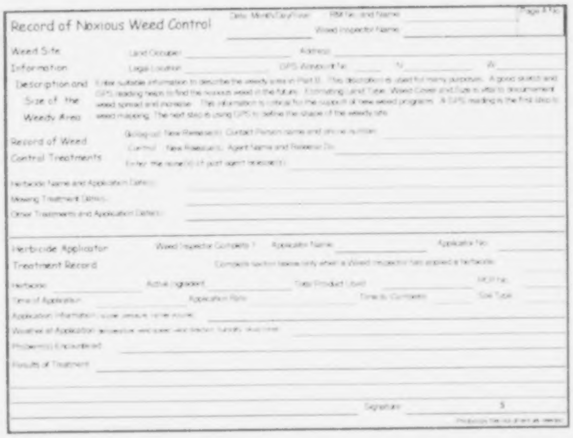
– Insects

– Plants, Animals

– Combination of non-conflicting methods



Pattern of Distribution



Record of Noxious Weed Control

Date: Month/Day/Year

RM No. and Name

Weed Inspector Name

Weed Site Information

Land Occupier

Address

Legal Location

GPS Waypoint No.

N

W

Description and Size of the Weedy Area

Record of Weed Control Treatments

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Herbicide Applicator Treatment Record

Applicator Name

Applicator No.

Herbicide

Active Ingredient

Total Product Used

Time of Application

Application Rate

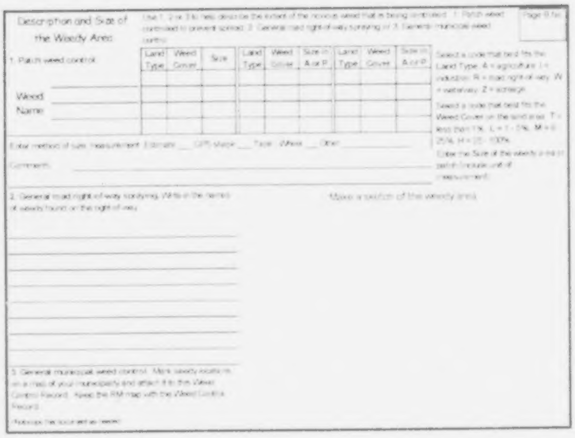
Soil Type

Problem(s) Encountered

Results of Treatment

Signature

$



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1. Patch weed control

Land Type	Weed Cover	Size	Land Type	Weed Cover	Size in A or P	Land Type	Weed Cover	Size in A or P

Weed Name

Comments

Make a sketch of the weedy area

Watch List

Identification

Biology & Ecology

Location

- Field Bindweed
- Leafy Spurge
- Yellow Toadflax
- Common Tansy
- Spotted Knapweed
- Wild Parsnip
- Hoary Alyssum

Wanted Dead

- Field Bindweed
- Leafy Spurge
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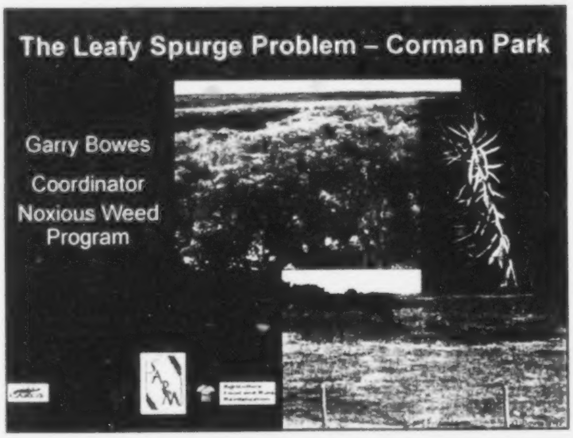

The Leafy Spurge Problem – Corman Park

Garry Bowes

Coordinator

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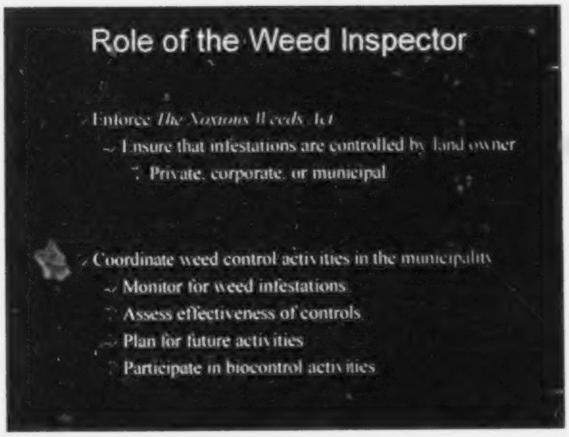

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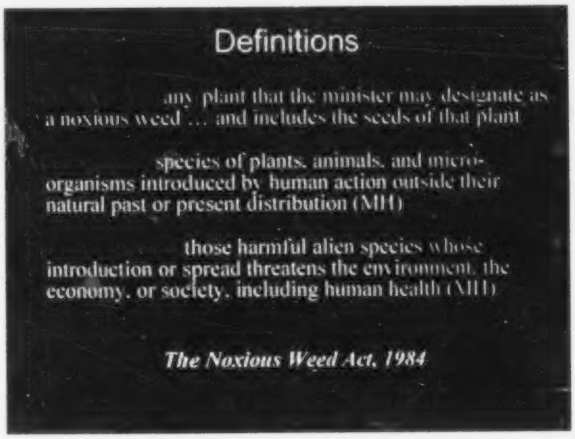

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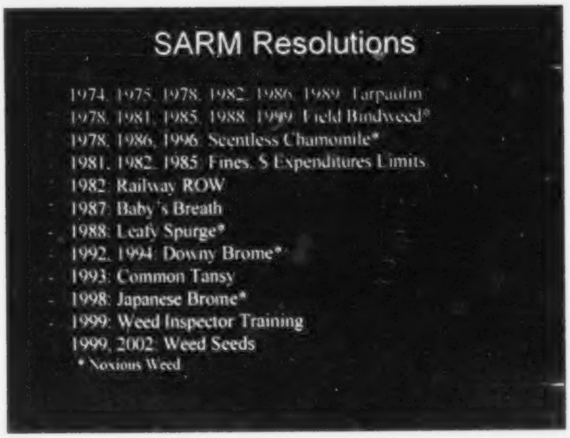

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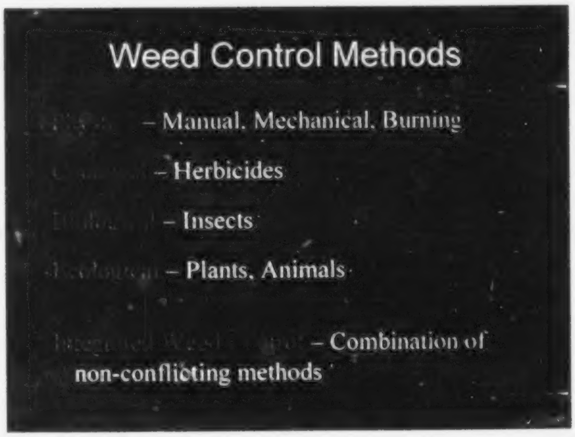
* Noxious Weed



Weed Control Methods

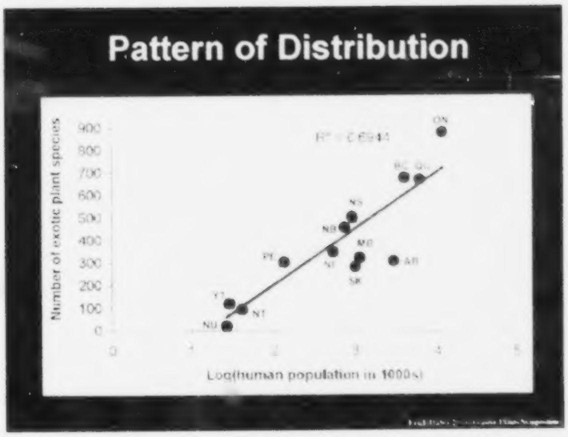
Physical – Manual, Mechanical, Burning

Chemical – Herbicides

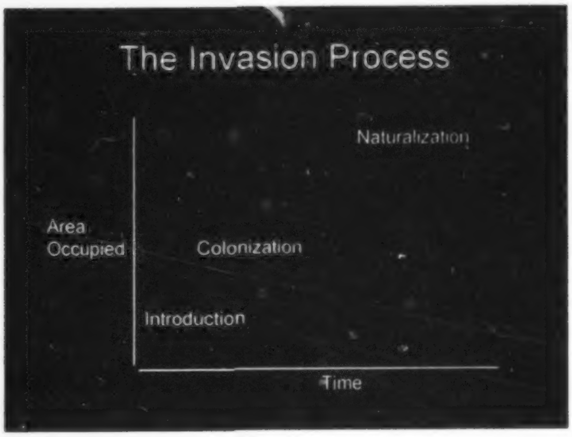
Biological – Insects

Ecological – Plants, Animals

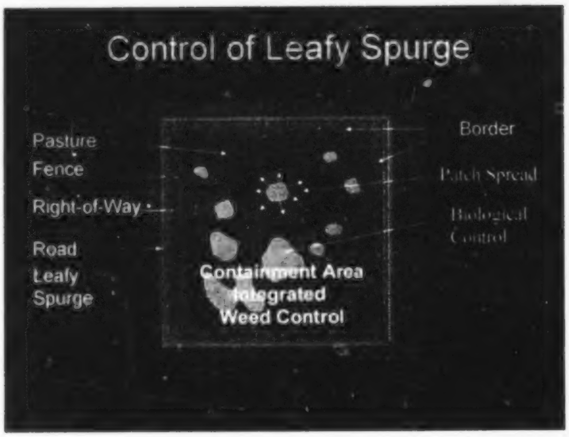
Integrated Weed Management – Combination of non-conflicting methods



Pattern of Distribution

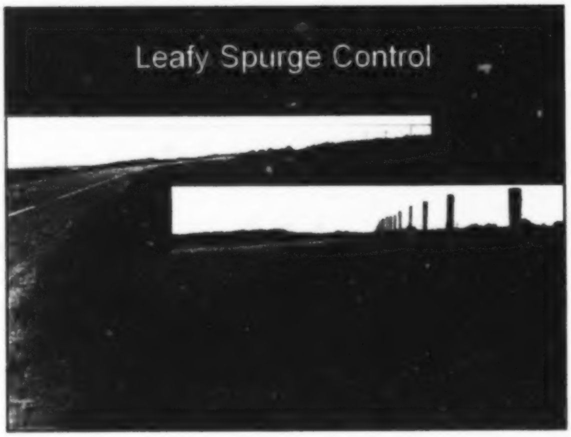


The Invasion Process

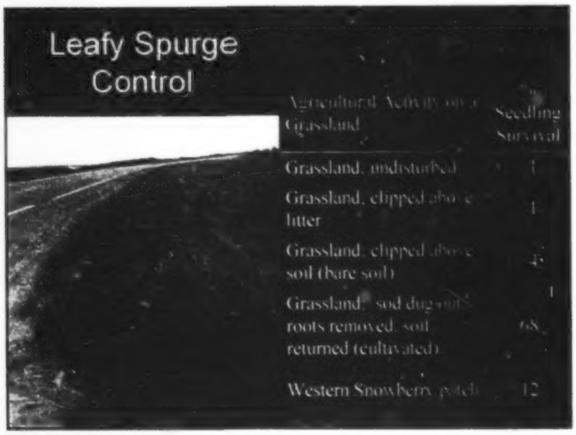


Control of Leafy Spurge

Leafy Spurge Control - Border



Leafy Spurge Control

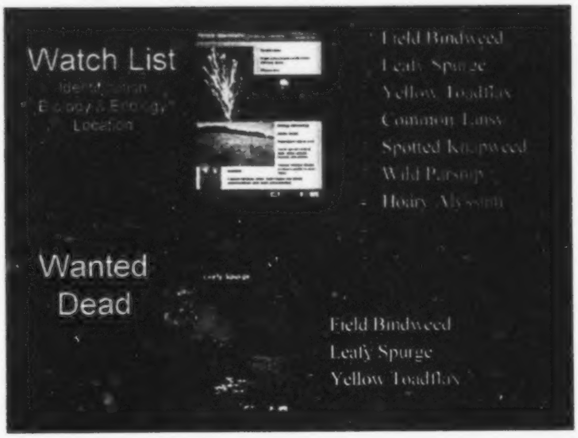


Leafy Spurge Control

Agricultural Activity on a Grassland	% Seedling Survival
Grassland, undisturbed	1
Grassland, clipped above litter	1
Grassland, clipped above soil (bare soil)	45
Grassland, sod dug out, roots removed, soil returned (cultivated)	68
Western Snowberry patch	12

Ability of Weeds to Reproduce

Noxious Perennial Weeds	Viable seed in soil (Yrs)	Underground structures producing top growth
1 Field bindweed	20, up to 50	Creeping Rootstocks
2 Heart-podded hoary cress	3	Creeping Rootstocks
3 Leafy spurge	Up to 8	Creeping Rootstocks
4 Russian knapweed	3 - 8	Creeping Rootstocks
5 Yellow toadflax	8	Creeping Rootstocks
Other Feared Noxious Weeds		
1. Scentless chamomile	Up to 10	nil
2. Spotted knapweed	8 or more	Crowns



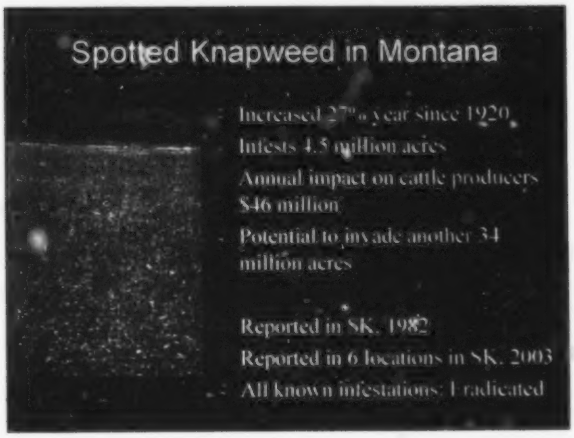
Watch List

Identification
Biology & Ecology
Location

- Field Bindweed
- Leafy Spurge
- Yellow Toadflax
- Common Tansy
- Spotted Knapweed
- Wild Parsnip
- Hoary Alyssum

Wanted Dead

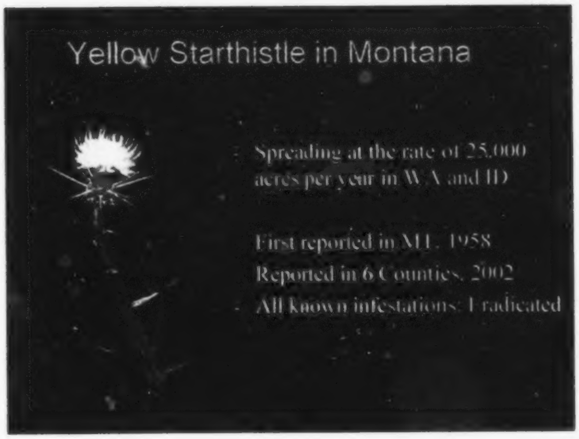
- Field Bindweed
- Leafy Spurge
- Yellow Toadflax



Spotted Knapweed in Montana

- Increased 27% a year since 1920
- Infests 4.5 million acres
- Annual impact on cattle producers $46 million
- Potential to invade another 34 million acres

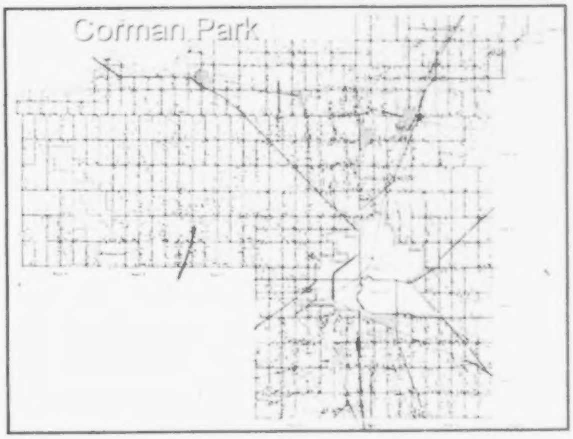
- Reported in SK. 1982
- Reported in 6 locations in SK. 2003
- All known infestations: Eradicated



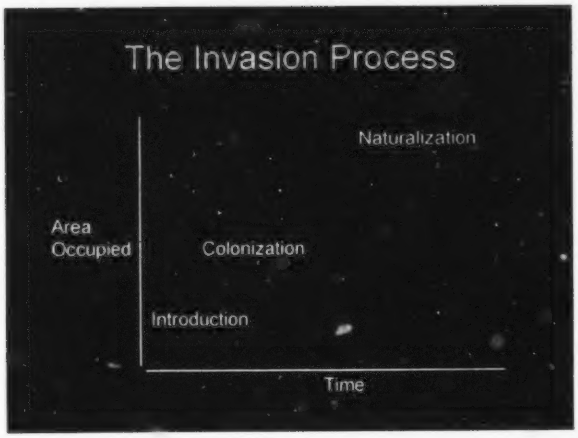
Yellow Starthistle in Montana

- Spreading at the rate of 25,000 acres per year in WA and ID

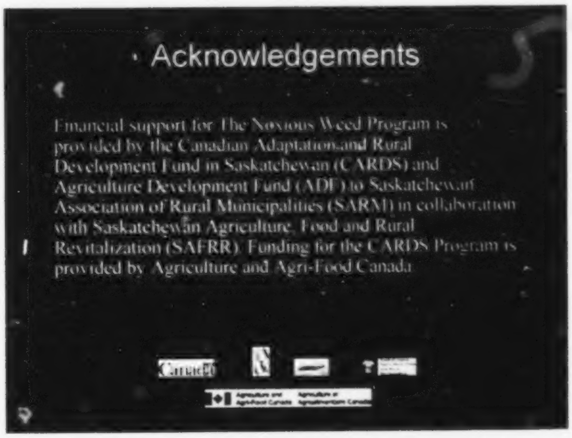
- First reported in MT. 1958
- Reported in 6 Counties, 2002
- All known infestations: Eradicated



Corman Park



The Invasion Process



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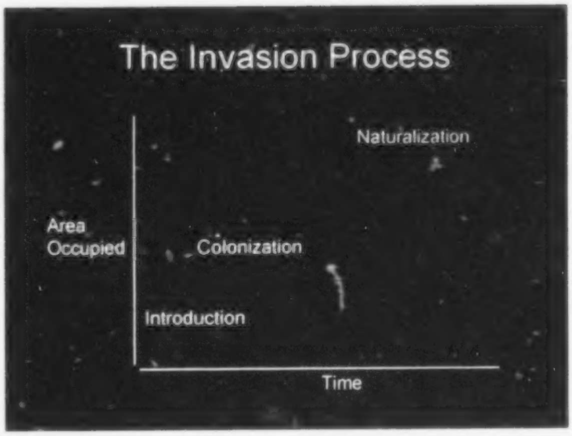


The Invasion Process

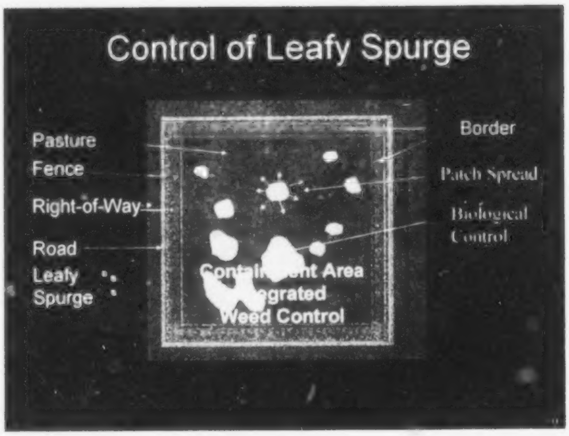
Area Occupied

Naturalization

Colonization

Introduction

Time



Control of Leafy Spurge

Pasture

Fence

Right-of-Way

Road

Leafy Spurge

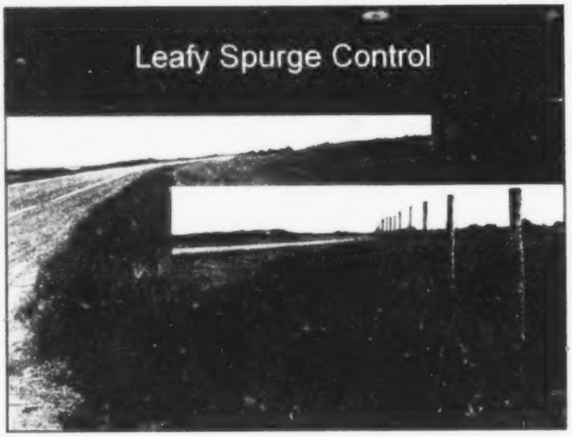
Border

Patch Spread

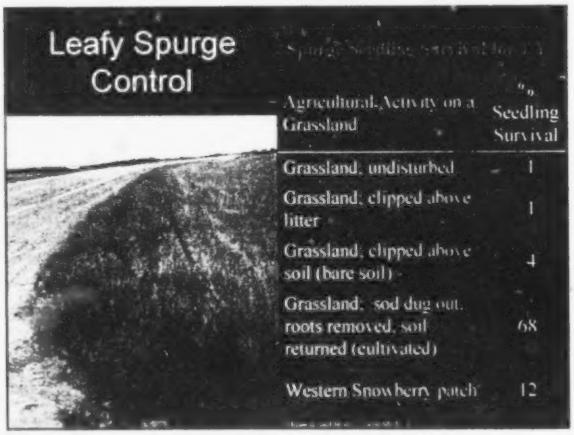
Biological Control

Containment Area Integrated Weed Control

Leafy Spurge Control - Border



Leafy Spurge Control



Leafy Spurge Control

Spurge Seedling Survival for [illegible]

Agricultural Activity on a Grassland	% Seedling Survival
Grassland, undisturbed	1
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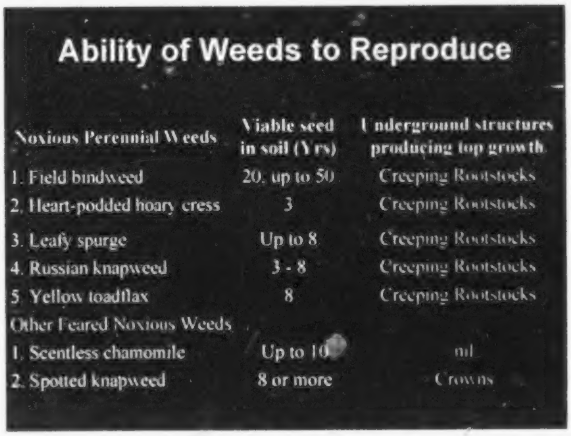

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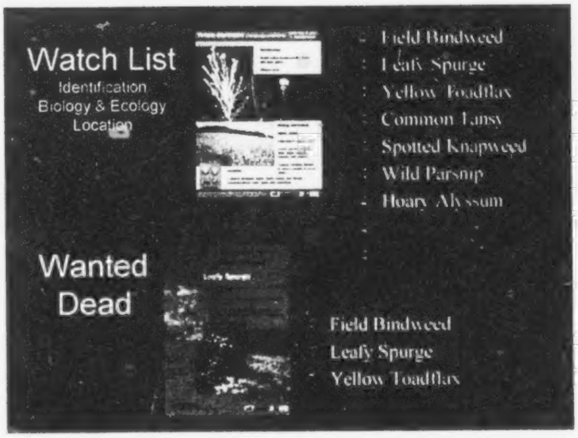

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- Common Tansy
- Spotted Knapweed
- Wild Parsnip
- Hoary Alyssum

Wanted Dead

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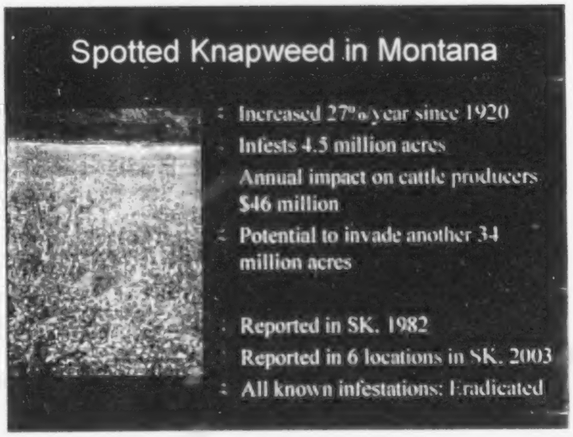
- Leafy Spurge
- Yellow Toadflax



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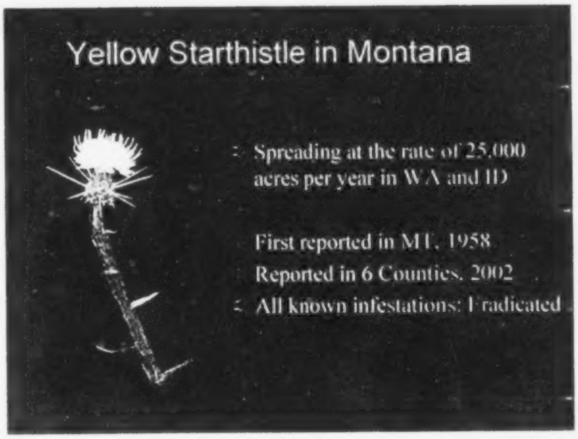

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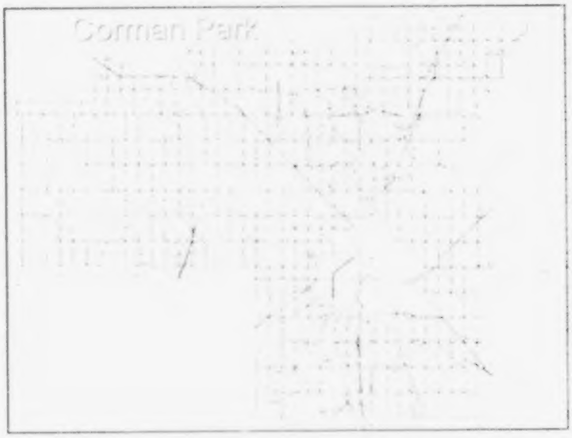
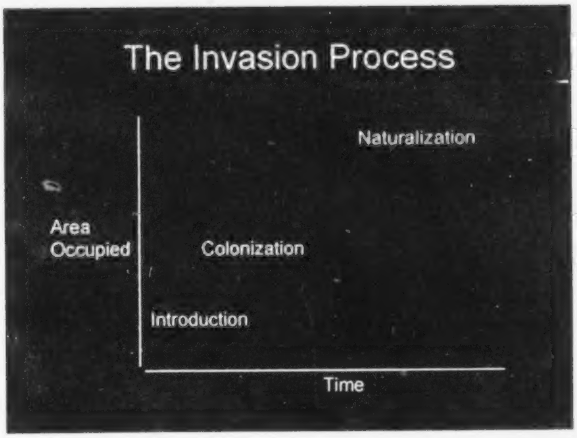


Corman Park



The Invasion Process

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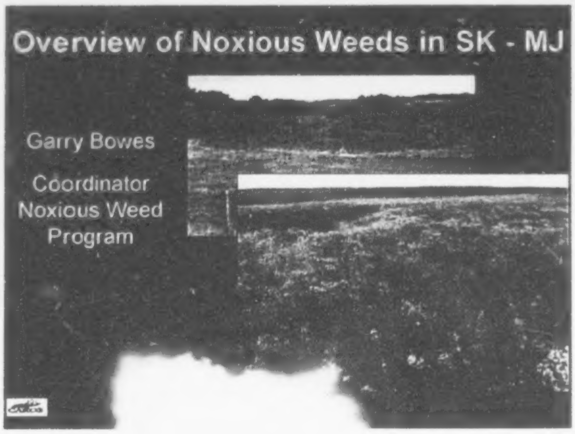

Overview of Noxious Weeds in SK - MJ

Garry Bowes

Coordinator
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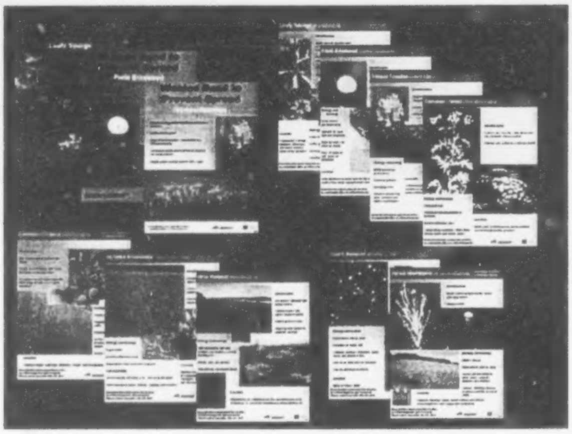

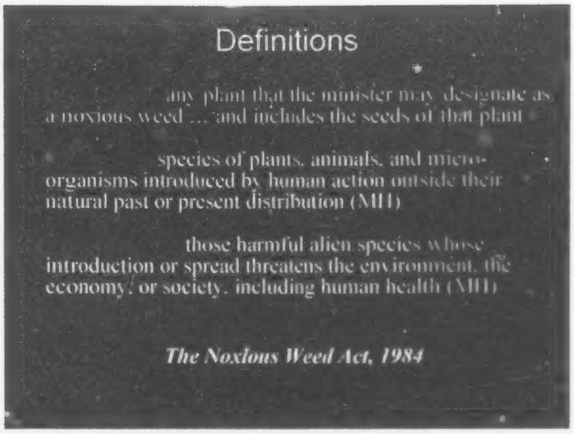

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species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution (MH)

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The Noxious Weed Act, 1984

Leafy Spurge - Spread

- Patches, green yellow bracts
- Latex, deep roots

- Dominates pastures
- Cattle refuse to eat

- Lateral root spread
- Seed catapult 15 ft (satellite infestation)
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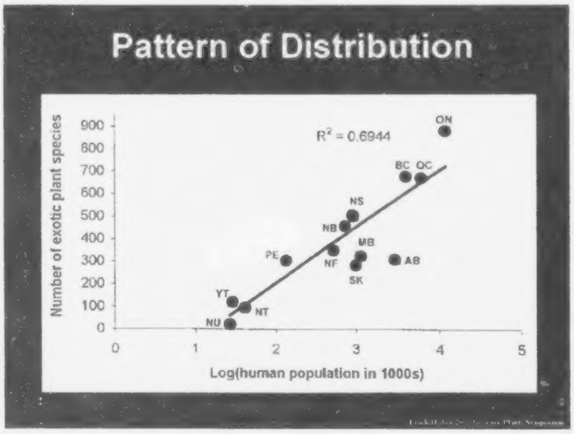
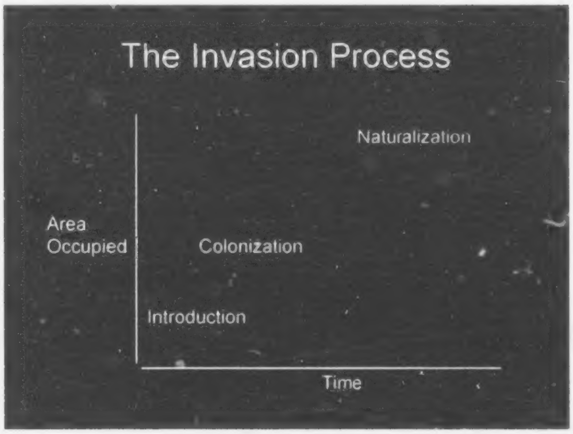


Pattern of Distribution



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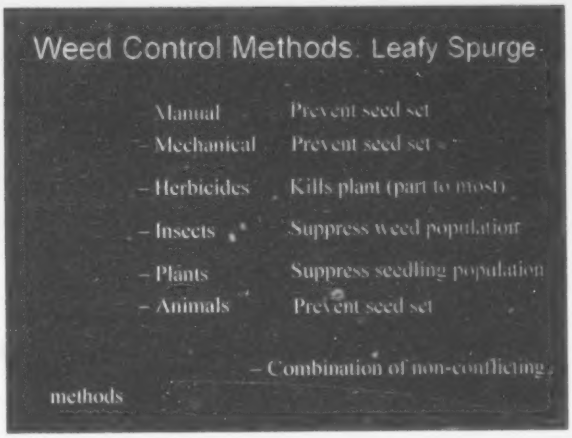

Weed Control Methods: Leafy Spurge

Manual	Prevent seed set
– Mechanical	Prevent seed set
– Herbicides	Kills plant (part to most)
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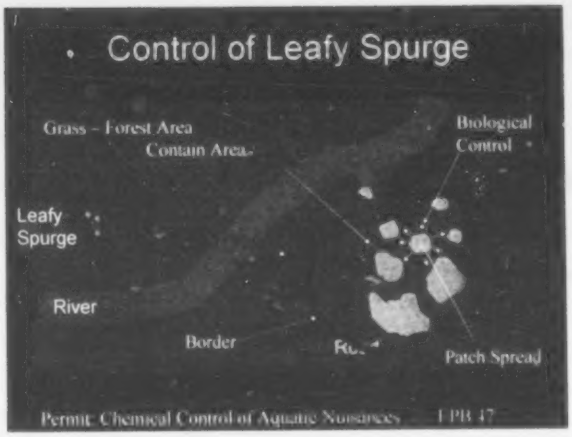
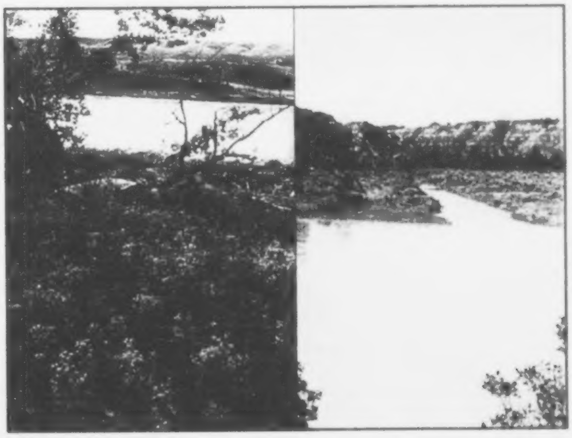
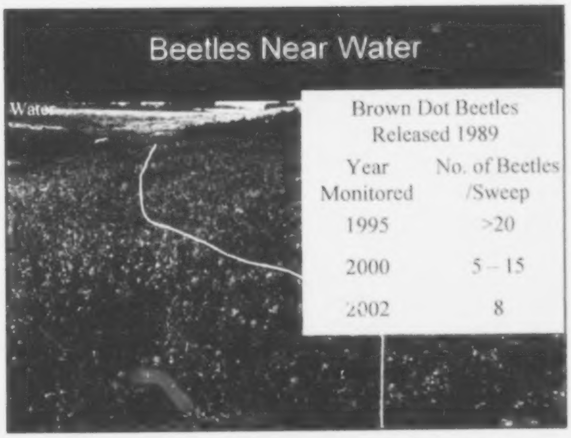


Control of Leafy Spurge

Permit: Chemical Control of Aquatic Nuisances EPB 47

Leafy Spurge Control - Border





Beetles Near Water

Brown Dot Beetles
Released 1989

Year Monitored	No. of Beetles /Sweep
1995	>20
2000	5 – 15
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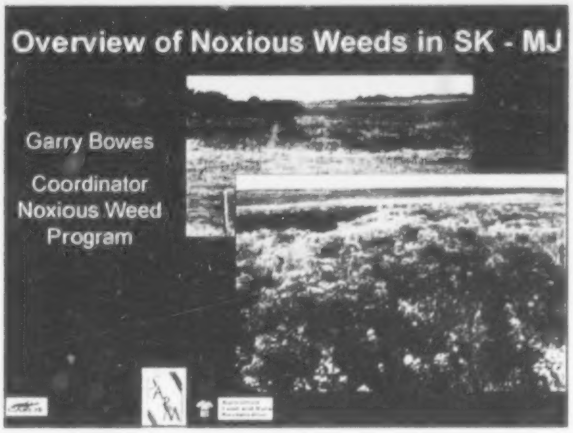

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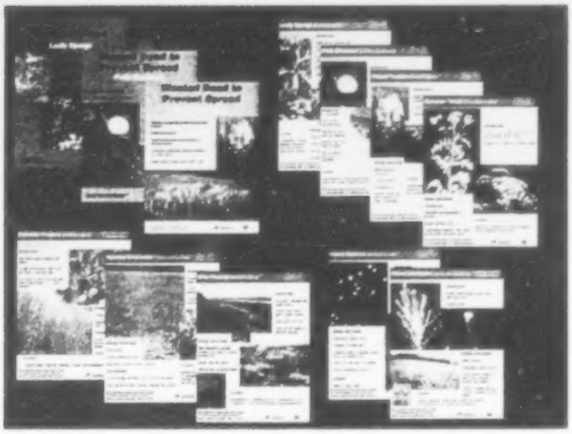

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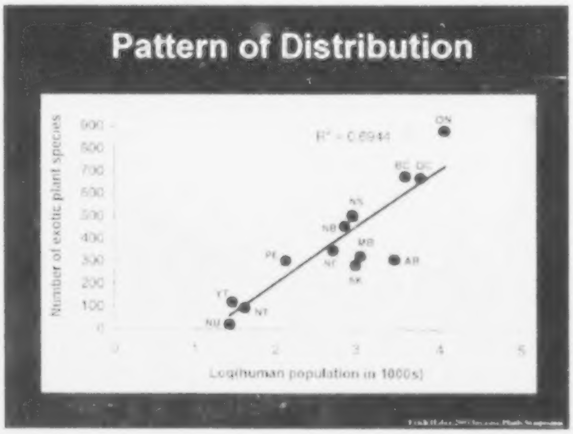

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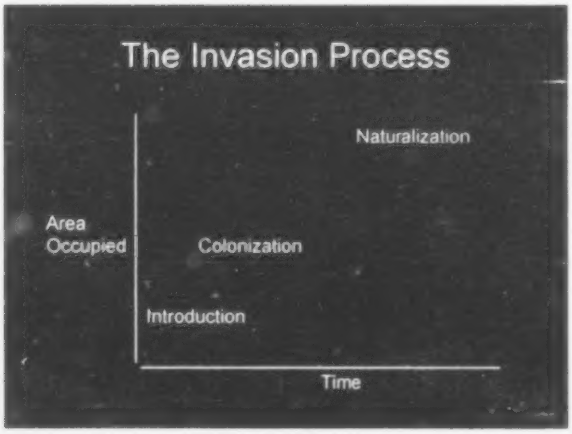
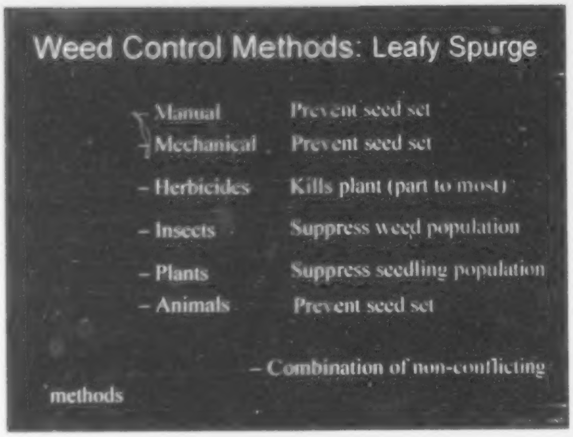


The Invasion Process



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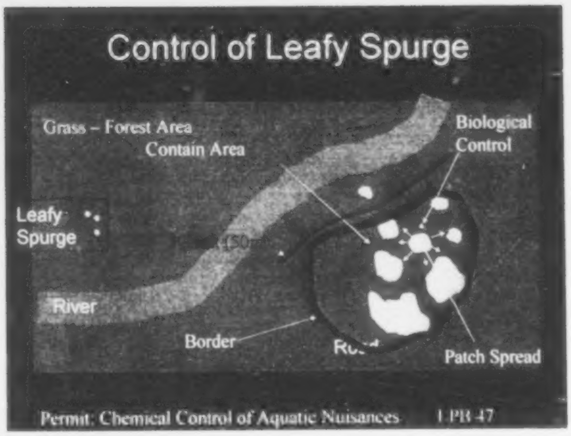

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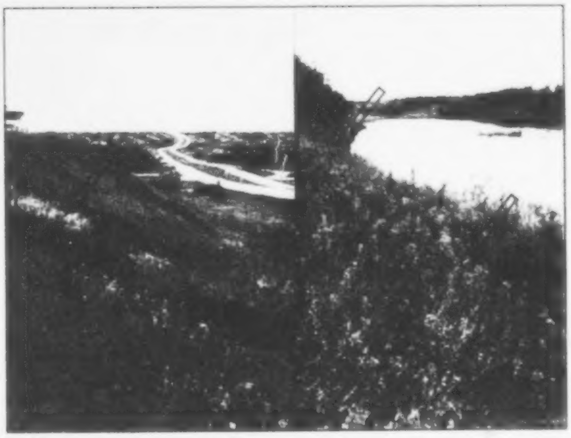

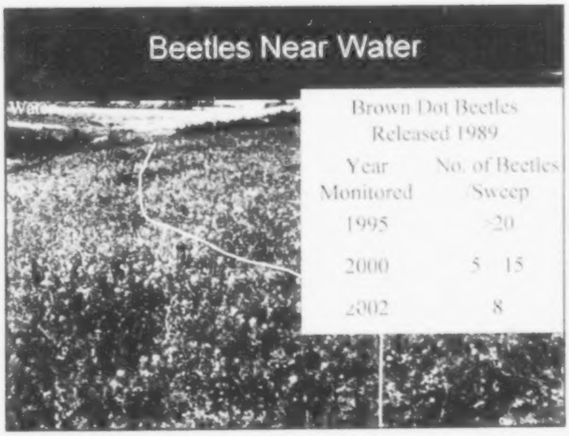

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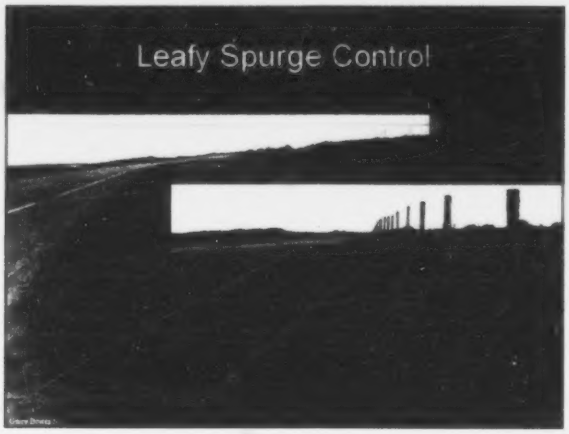
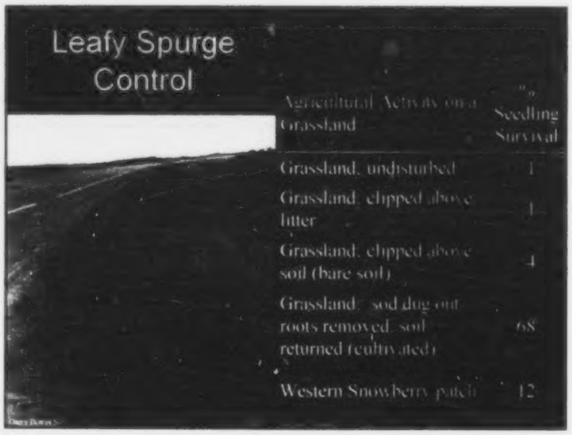


Leafy Spurge Control

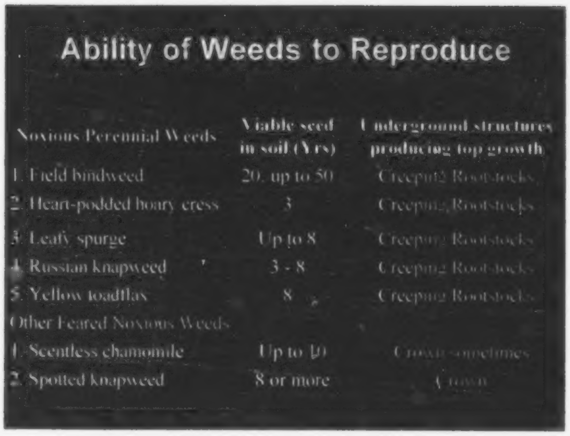
Garry Bowes ©



Leafy Spurge Control

Agricultural Activity on a Grassland	% Seedling Survival
Grassland, undisturbed	1
Grassland, clipped above litter	1
Grassland, clipped above soil (bare soil)	4
Grassland: sod dug out, roots removed, soil returned (cultivated)	68
Western Snowberry patch	12

Garry Bowes ©



Ability of Weeds to Reproduce

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1. Field bindweed	20, up to 50	Creeping Rootstocks
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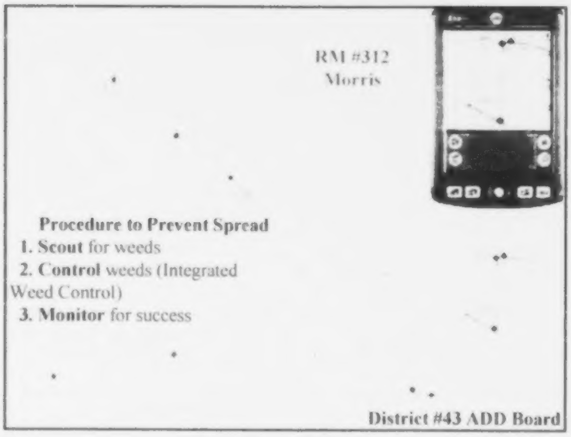

RM #312
Morris

Procedure to Prevent Spread

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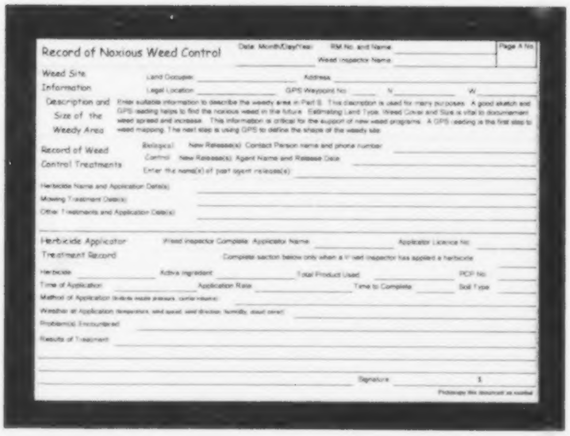
District #43 ADD Board



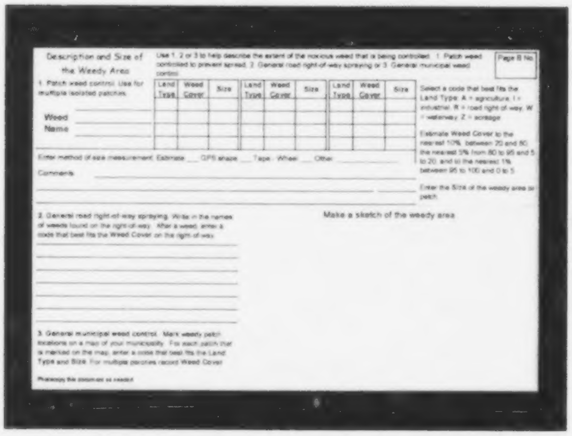
Record of Noxious Weed Control
Date: Month/Day/Year
RM No. and Name
Weed Inspector Name
Page A No.

Weed Site Information
Land Occupier
Address
Legal Location
GPS Waypoint No.
N
W

Description and Size of the Weedy Area
Enter suitable information to describe the weedy area in Part B. This description is used for many purposes. A good sketch and GPS reading helps to find the noxious weed in the future. Estimating Land Type, Weed Cover and Size is vital to documenting weed spread and increase. This information is critical for the support of new weed programs. A GPS reading is the first step to weed mapping. The next step is using GPS to define the shape of the weedy site.

Record of Weed Control Treatments
Biological Control
New Release(s): Contact Person name and phone number
New Release(s): Agent Name and Release Date
Enter the name(s) of past agent release(s):
Herbicide Name and Application Date(s)
Mowing Treatment Date(s)
Other Treatments and Application Date(s)

Herbicide Applicator Treatment Record
Weed Inspector Complete: Applicator Name
Applicator Licence No.
Complete section below only when a Weed Inspector has applied a herbicide
Herbicide
Active Ingredient
Total Product Used
PCP No.
Time of Application
Application Rate
Time to Complete
Soil Type
Method of Application (include nozzle pressure, carrier volume)
Weather at Application (temperature, wind speed, wind direction, humidity, cloud cover)
Problem(s) Encountered
Results of Treatment
Signature
Photocopy this document as needed



Description and Size of the Weedy Area
Use 1, 2 or 3 to help describe the extent of the noxious weed that is being controlled. 1. Patch weed controlled to prevent spread. 2. General road right-of-way spraying or 3. General municipal weed control.
Page B No.

1. Patch weed control. Use for multiple isolated patches.

	Land Type	Weed Cover	Size	Land Type	Weed Cover	Size	Land Type	Weed Cover	Size
Weed Name									

Select a code that best fits the Land Type: A = agriculture, I = industrial, R = road right of way, W = waterway, Z = acreage

Estimate Weed Cover to the nearest 10%, between 20 and 80, the nearest 5% from 80 to 95 and 5 to 20, and to the nearest 1% between 95 to 100 and 0 to 5

Enter the Size of the weedy area or patch

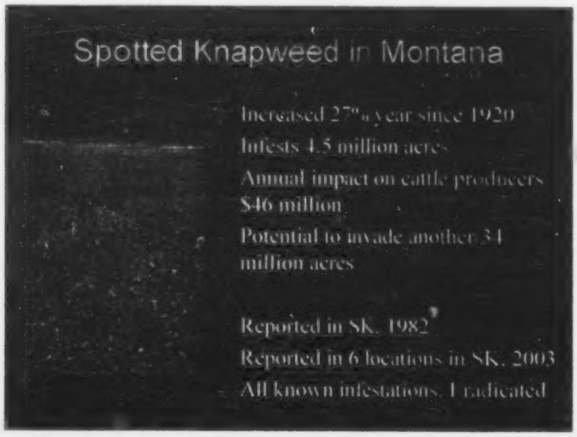
Enter method of size measurement: Estimate ___ GPS shape ___ Tape - Wheel ___ Other ___
Comments

2. General road right-of-way spraying. Write in the names of weeds found on the right-of-way. After a weed, enter a code that best fits the Weed Cover on the right-of-way.

Make a sketch of the weedy area

3. General municipal weed control. Mark weedy patch locations on a map of your municipality. For each patch that is marked on the map, enter a code that best fits the Land Type and Size. For multiple patches record Weed Cover.

Photocopy this document as needed



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- Infests 4.5 million acres
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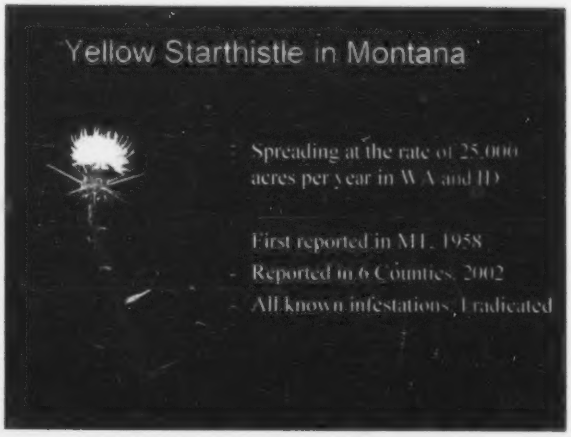

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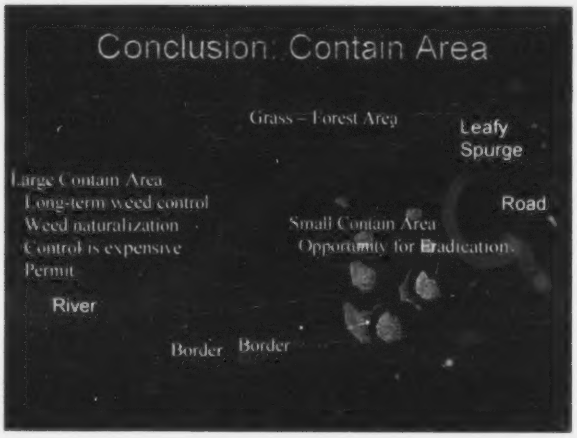

Conclusion: Contain Area

Large Contain Area
- Long-term weed control
- Weed naturalization
- Control is expensive
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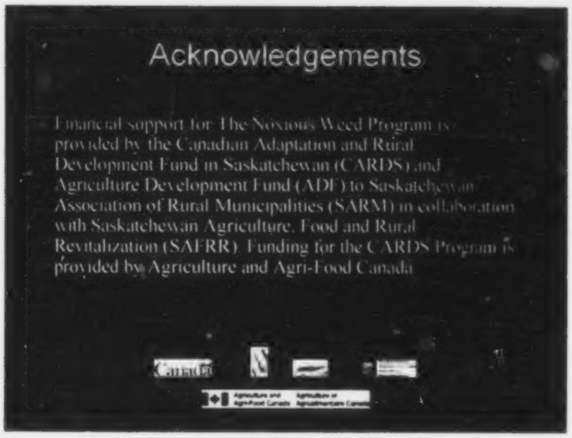
- Opportunity for Eradication



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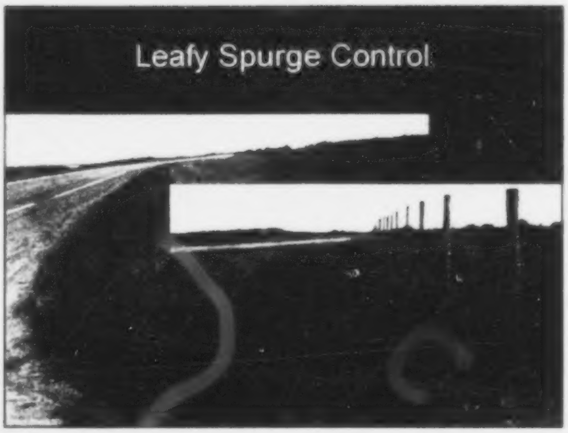
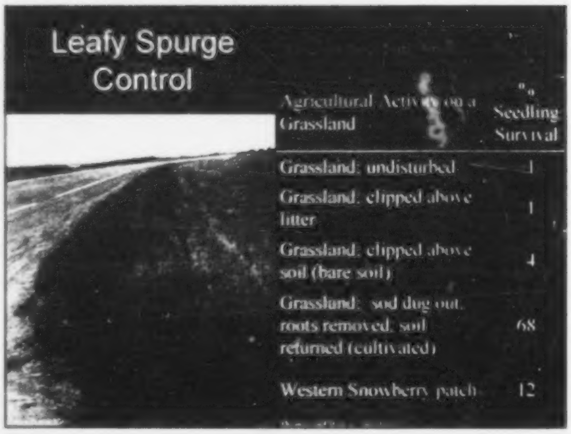


Leafy Spurge Control



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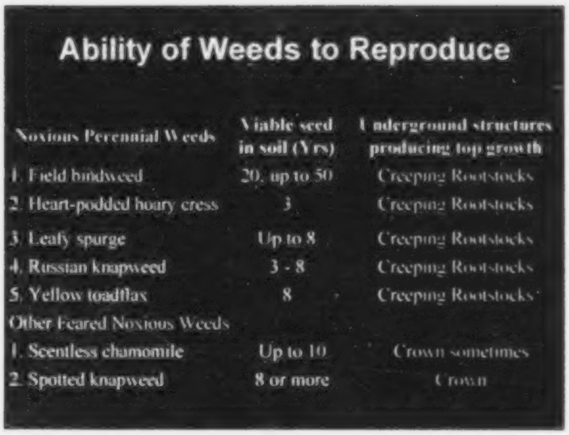

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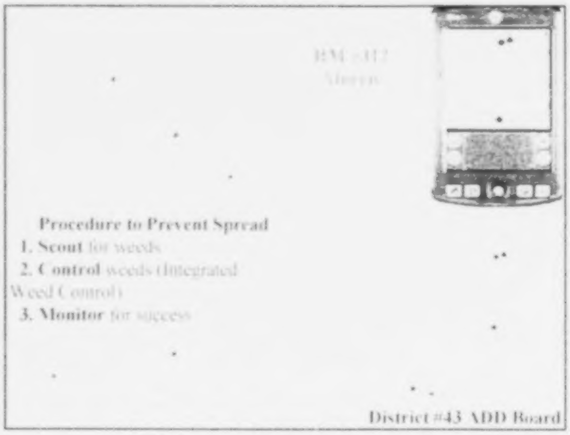

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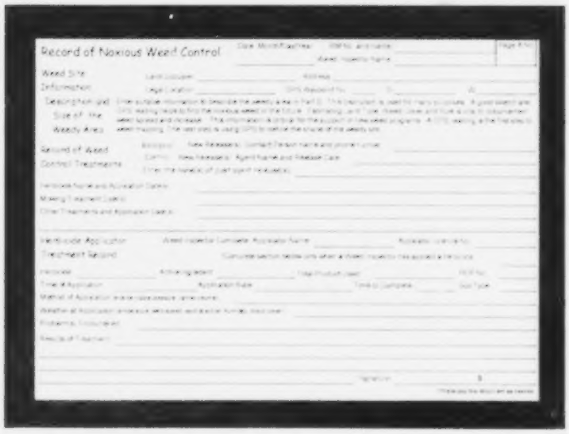

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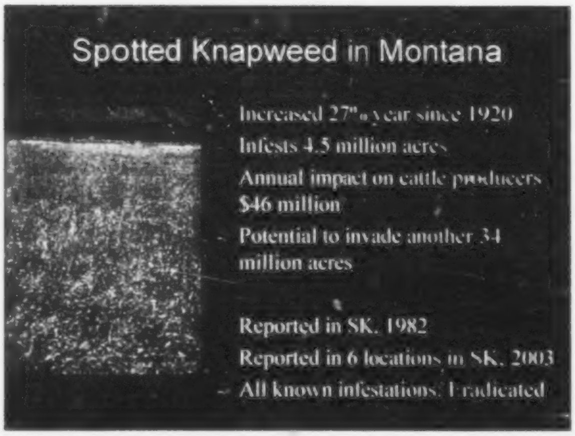

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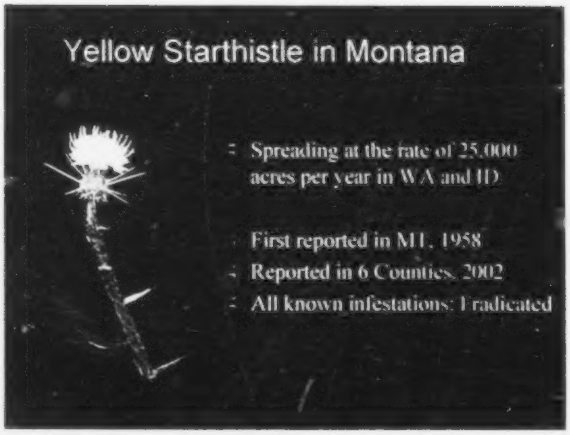

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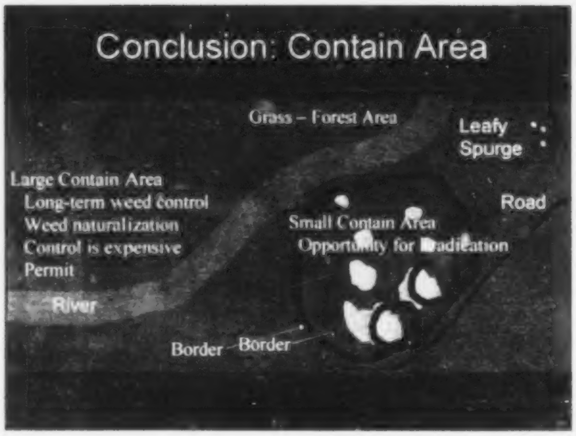

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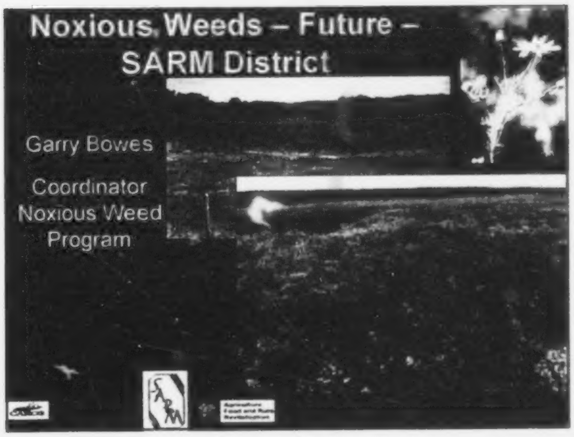

Noxious Weeds – Future – SARM District

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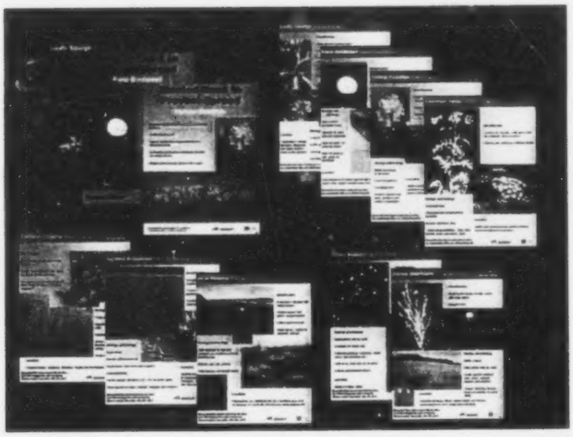

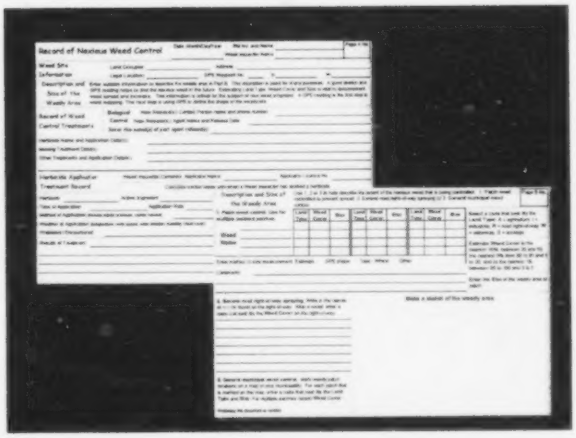

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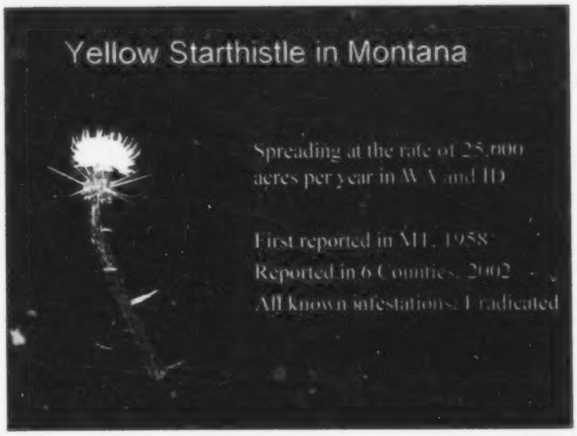

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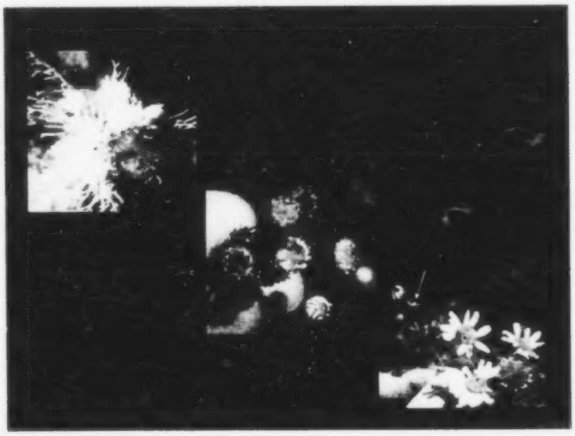

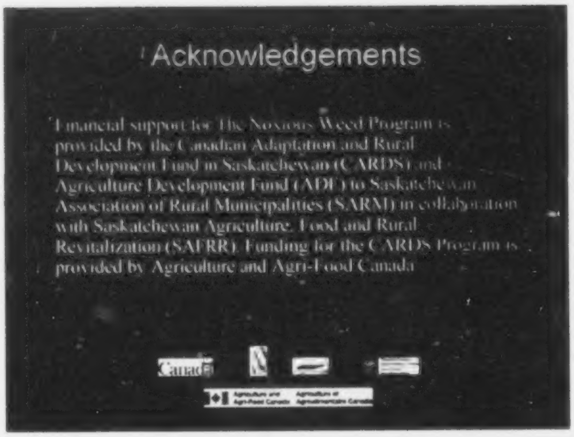

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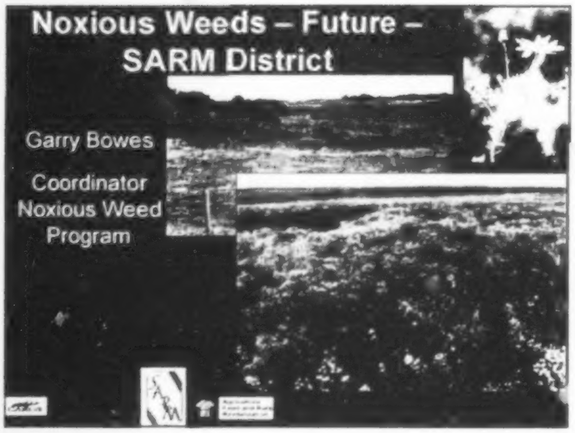

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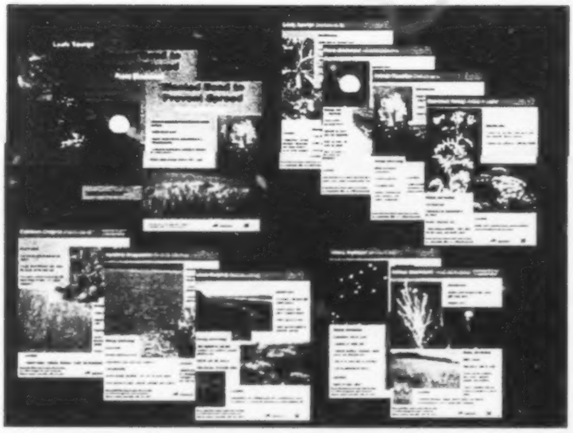
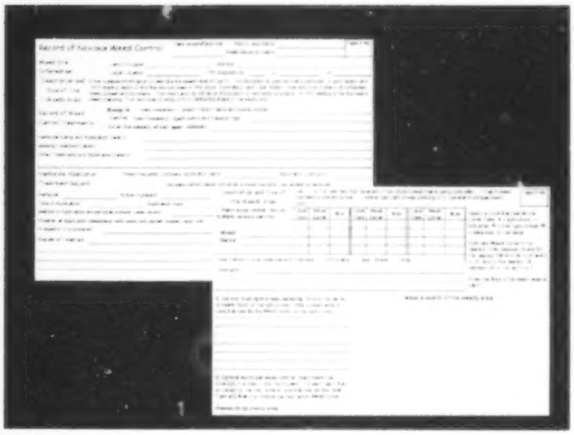
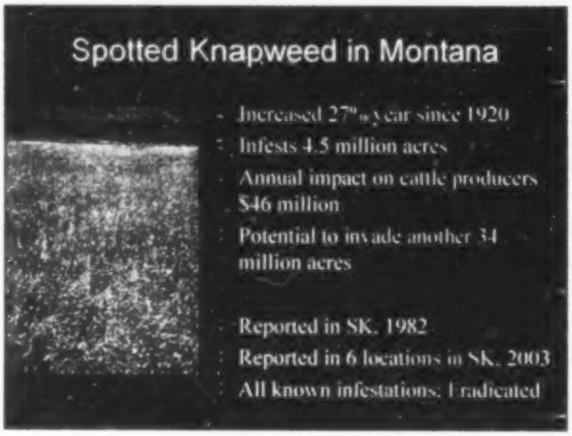
Program





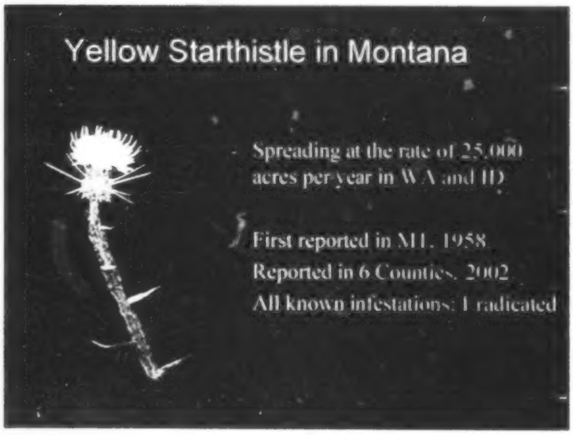
Record of Noxious Weed Control



Spotted Knapweed in Montana

- Increased 27%/year since 1920
- Infests 4.5 million acres
- Annual impact on cattle producers $46 million
- Potential to invade another 34 million acres

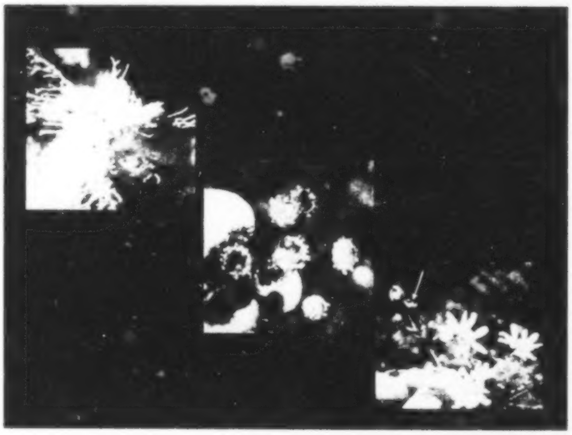
- Reported in SK. 1982
- Reported in 6 locations in SK. 2003
- All known infestations: Eradicated

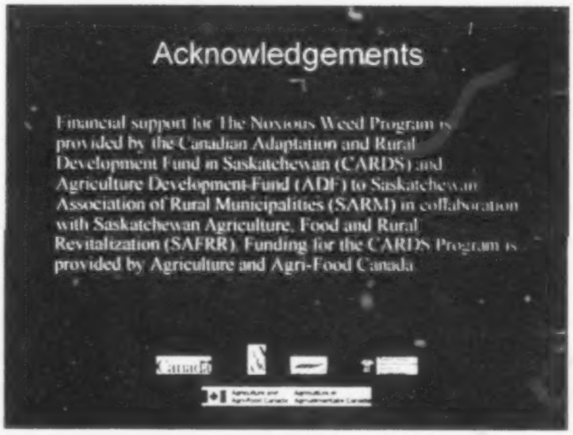


Yellow Starthistle in Montana

- Spreading at the rate of 25,000 acres per year in WA and ID

- First reported in MT. 1958
- Reported in 6 Counties. 2002
- All known infestations: Eradicated





Acknowledgements

Financial support for The Noxious Weed Program is provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development-Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada

Report to the Meeting of the Weed Sub-council to the Saskatchewan Advisory Council on Soils & Agronomy, November 12, 2003

Title: Noxious Weed Program

Funding for the Noxious Weed Management Program

The Noxious Weed Management Program started on April 1999 and has been extended to April 2005. The Saskatchewan Association of Rural Municipalities with technical support supplied by Saskatchewan Agriculture, Food and Rural Revitalization manages the program.

Financial support for The Noxious Weed Program is provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada.

Weed Inspector Appointments

- In 2003, 202 Rural Municipalities and 10 Urban Municipalities appointed Weed Inspectors.
- Saskatchewan has 367 Weed Inspectors.

- Mailed the following to 319 Weed Inspectors;
  1. Map, showing the distribution of scentless chamomile along road rights-of-ways (miles of roads by rural municipality).
  2. Map showing seed weevil release sites in the province.
  3. Map showing gall midge release sites.
  4. List of sites for collecting leafy spurge flea beetles.

Extension Agrologists

- E-mailed a copy of the 2003 Scentless Chamomile Biological Control Agent Information Guide (contains a list of release sites).
- 2003 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide (contains a list of release sites).

Biological Control Agents for Scentless Chamomile

The agents are the scentless chamomile seed weevil (*Omphalapion hookeri*), stem weevil (*Microplontus edentulus*) and gall midge (*Rhopalomyia tripleurospermi*).

Scentless Chamomile Seed Weevil

- Monitored 40 scentless chamomile seed weevil release sites for the weevils. Most releases establish. The main reason for failure is the lack of scentless chamomile plants in the future.
- Presentation at the 2003 Weed Inspector Training Clinics (WITC). The WITCs are organized by Clark Brenzil and held during the first week in April at 3 locations (Swift Current, Outlook and Tisdale) in the province. Topic was the spread of scentless chamomile biological control agents. Seed weevils appear to be moving about 15 km in 10 yrs and the gall midges 10 km in 4 yrs.
- Collected seed heads from scentless chamomile plants for five weevil releases. These were released in an abandoned gravel pit to start a new collection area.

Scentless Chamomile Stem Weevil

The stem weevil is a strong flier and once released is difficult to locate. Stem weevils are difficult to work with and progress on establishment is slow. Stem weevils have over winter in the province.

Scentless Chamomile Gall Midge

- Collected sufficient scentless chamomile plants with galls in the spring for 6 releases.
- Monitored 22 release sites for gall midges. Midge establishment is good. One problem is grasshoppers eating winter annual plants with galls.

Leafy Spurge

- Presentation at 2003 WITC on leafy spurge eradication and containment.
- Special presentation on leafy spurge control at Estevan. Covered all aspects of leafy spurge control, including how to organize to collect beetles.
- Monitored 110 leafy spurge beetle release sites for the presence of the beetles. At 34% of the release sites, leafy spurge cover was ≤ 15% and grazing loss would be ≤ 19%.
- Last Mountain House Provincial Park should be a good site for collecting leafy spurge beetles in 2004.

SARM District Meetings

- Presentation, an update of the Noxious Weed Control Program, was made at the June 2003 SARM District Meetings (6 locations).

Garry Bowes
Coordinator
Noxious Weed Management Program
3830 Thatcher Avenue
Saskatoon, SK
S7K 2H6

p 306 933-7695
f 306 933-7352
i gbowes@agr.gov.sk.ca

Report to the Meeting of the Weed Sub-council to the Saskatchewan Advisory Council on Soils & Agronomy, April 15, 2004

Title: Noxious Weed Management Program Update

The Noxious Weed Management Program started April 1999. The program focuses on the spread of scentless chamomile (80%), leafy spurge (20%) and others weeds.

Information obtained in the summer was combined with research literature and was presented in articles to The Rural Councillor, and at SARM conventions, winter meetings and the 2004 Weed Inspector Training Clinics.

1. Prepared and submitted four articles to The Rural Councillor.
2. Designed and prepared an Information Booth for the 2003 SARM Mid-Term and 2004 SARM Spring Conventions.
3. Prepared and presented 2 PowerPoint presentations for the 2004 Weed Inspector Training Clinics (WITC).
4. Planned and developed a Record Keeping system for Weed Inspectors.
5. Prepared a series of 9 Identification leaflets for awareness of weeds that are not known to grow in Saskatchewan, grow on a few isolated areas in the province or grow on many isolated areas in the province.
6. Prepared a series of 3 Wanted Dead leaflets for awareness of weeds.

2004 Biological Control Releases

1. Seed weevils and gall midges will be collected and redistributed. Major releases will be made in the City of Yorkton.
2. Clinics will be set up and run to encourage leafy spurge beetle collection and distribution.
3. Other agents will be released, as they are made available by Dr. McClay at ARC.

2004 Information Delivery

Prepare and deliver presentations and/or Information Booths at 2004 SARM Mid-Term Convention, 2004 SARM District Meetings, 2005 SARM Spring Convention and WITCs.

2004 Monitoring

As many as possible of the past releases of seed weevils (117), gall midges (50), stem weevils (6) and leafy spurge beetles (210) will be monitored. The priority for monitoring is to evaluate establishment and to continually find the best sites for collection.

Garry Bowes Coordinator, Noxious Weed Management Program
3830 Thatcher Avenue, Saskatoon, Saskatchewan, S7K 2H6

Phone: 306 933-7695, Fax: 306 933-7352, Internet: gbowes@agr.gov.sk.ca

Report to the Meeting of the Weed Sub-council to the Saskatchewan Advisory Council on Soils & Agronomy, November 3, 2004

Title: Noxious Weed Program

Funding for the Noxious Weed Management Program

The Noxious Weed Management Program that was started in April 1999 has funding to April 2005. The program is managed by Saskatchewan Association of Rural Municipalities with technical support supplied by Saskatchewan Agriculture, Food and Rural Revitalization. A proposal for new funding has been submitted (Environmental Technology Assessment for Agriculture (ETAA) Program).

Financial support for The Noxious Weed Program is provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada.

Weed Inspector Appointments

- In 2004, 155 Rural Municipalities and 6 Urban Municipalities appointed Weed Inspectors.
- Saskatchewan has 252 Weed Inspectors.

Biological Control Agents for Scentless Chamomile

The agents are the scentless chamomile seed weevil (*Omphalapion hookeri*), and gall midge (*Rhopalomyia tripleurospermi*).

Scentless Chamomile Seed Weevil

- Monitored 34 scentless chamomile seed weevil release site. Scentless chamomile flowered late and weevil counts were low.

Scentless Chamomile Gall Midge

- Monitored 18 release sites for gall midges. Galls were not found at sites with high populations of grasshoppers in 2003. In the fall of 2003, grasshoppers eat winter annual plants with galls.

Leafy Spurge

- Monitored 97 leafy spurge beetle release sites for the presence of the beetles. Adult beetles emerged 2 to 3 weeks later in 2004 than in 2003. Beetle counts were low in 2004.

2003 Weed Inspector Training Clinics (WITC)

- The WITCs are organized by Clark Brenzil and held at 3 locations (Moose Jaw on April 5th, Yorkton on April 6th and North Battleford on April 7th).
    - Delivered two presentations:
        - Biological Control
        - How to Prevent Weed Spread

    - Set up Information Booths at WITC. The information presented stressed:
        - How and when to collect scentless chamomile gall midges and seed weevils
        - How effective are leafy spurge beetles
        - Awareness of new weeds and weeds occupying small areas
        - A Weed Inspector record keeping system

SARM District Meetings

- Information booth and presentation were made at the 2004 SARM District Meetings (Kipling on June 15th, Moose Jaw on June 16th, Swift Current on June 17th, Kelvington on June 22nd, Saskatoon on June 23rd and Battleford on June 24th).

    - Presentation:
        - Noxious Weeds - Future

    - Information Booth:
        - Awareness of new weeds and weeds occupying small areas
        - A Weed Inspector record keeping system

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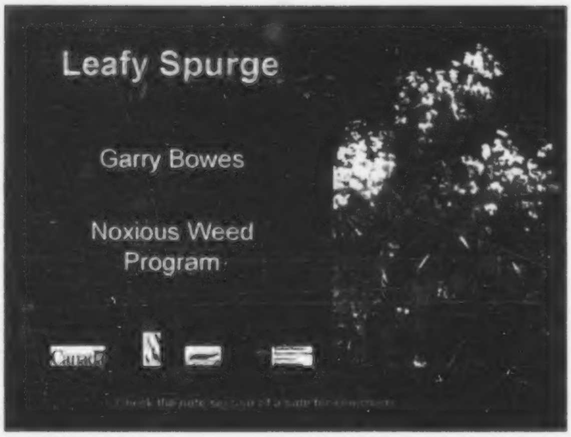

Leafy Spurge

Garry Bowes

Noxious Weed Program

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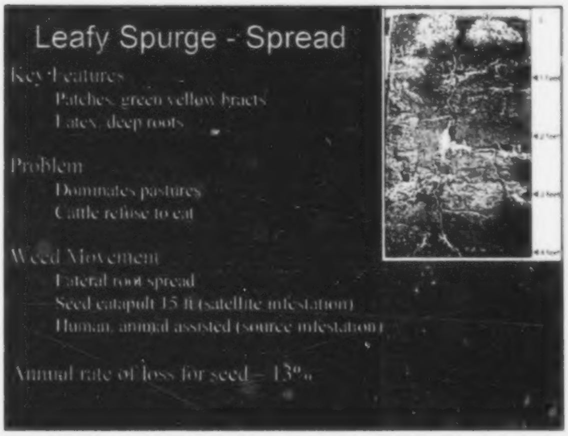


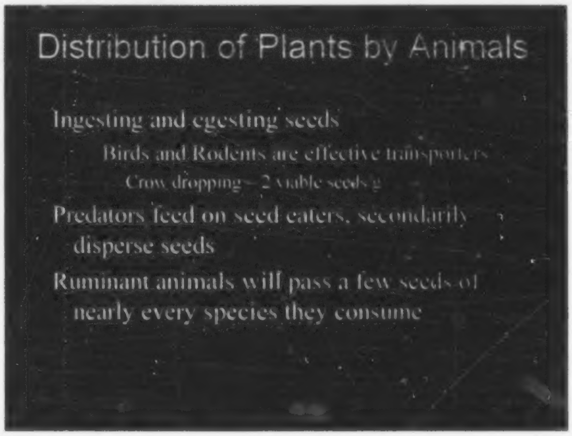
Leafy Spurge - Spread

Key Features
  Patches, green yellow bracts
  Latex, deep roots

Problem
  Dominates pastures
  Cattle refuse to eat

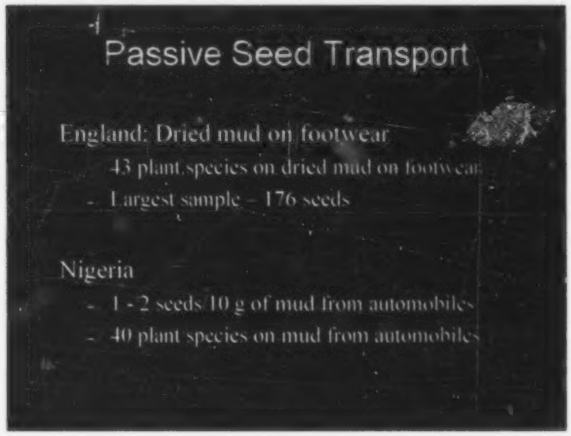
Weed Movement
  Lateral root spread
  Seed catapult 15 ft (satellite infestation)
  Human, animal assisted (source infestation)

Annual rate of loss for seed – 13%



Distribution of Plants by Animals

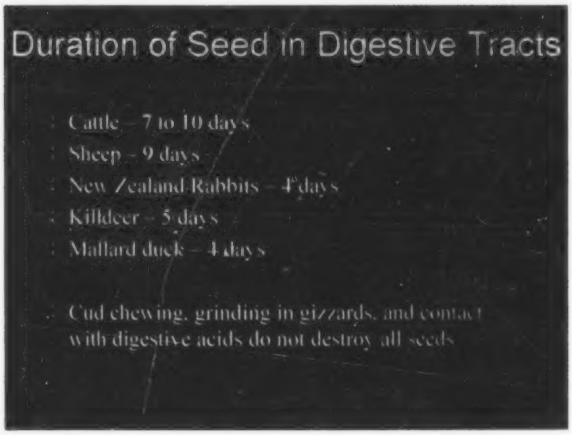
- Ingesting and egesting seeds
  - Birds and Rodents are effective transporters
    - Crow dropping – 2 viable seeds/g
- Predators feed on seed eaters, secondarily disperse seeds
- Ruminant animals will pass a few seeds of nearly every species they consume



Passive Seed Transport

England: Dried mud on footwear
  - 43 plant species on dried mud on footwear
  - Largest sample – 176 seeds

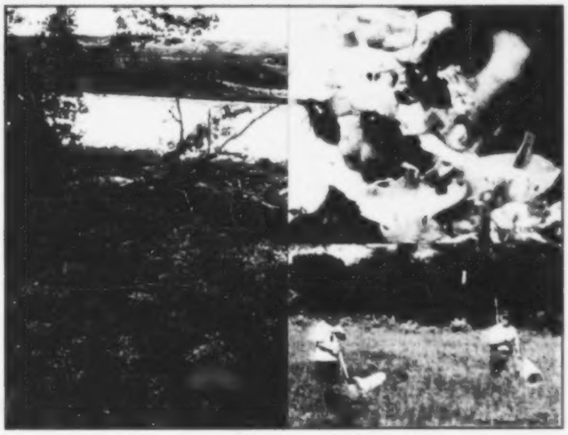
Nigeria
  - 1 - 2 seeds/10 g of mud from automobiles
  - 40 plant species on mud from automobiles

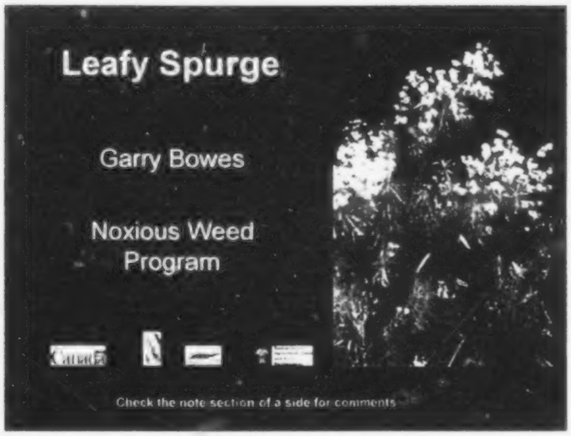


Duration of Seed in Digestive Tracts

- Cattle – 7 to 10 days
- Sheep – 9 days
- New Zealand Rabbits – 4 days
- Killdeer – 5 days
- Mallard duck – 4 days

- Cud chewing, grinding in gizzards, and contact with digestive acids do not destroy all seeds





Leafy Spurge

Garry Bowes

Noxious Weed Program

Canada

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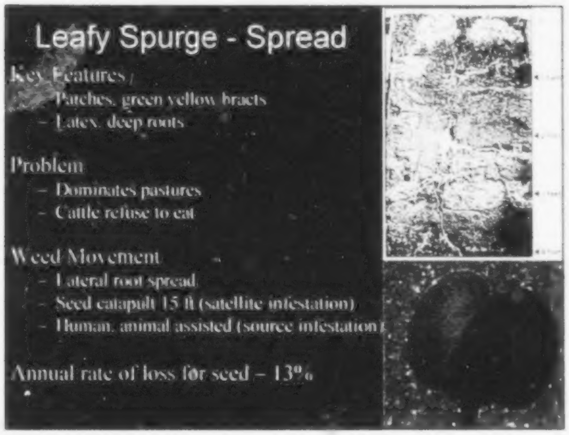

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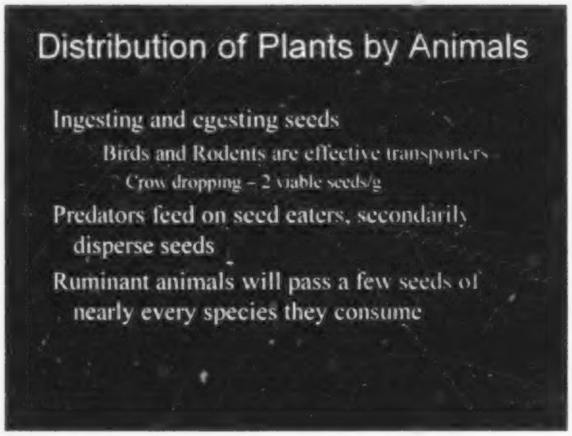

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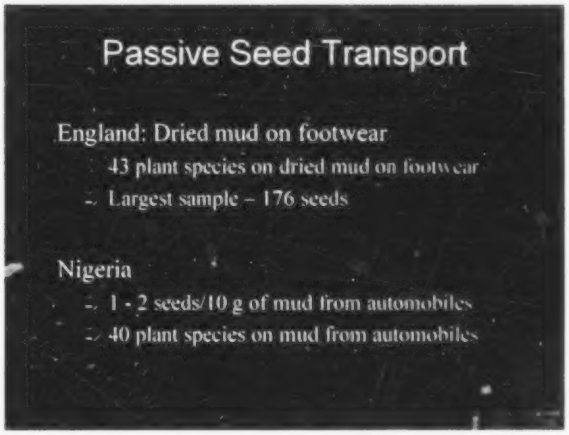

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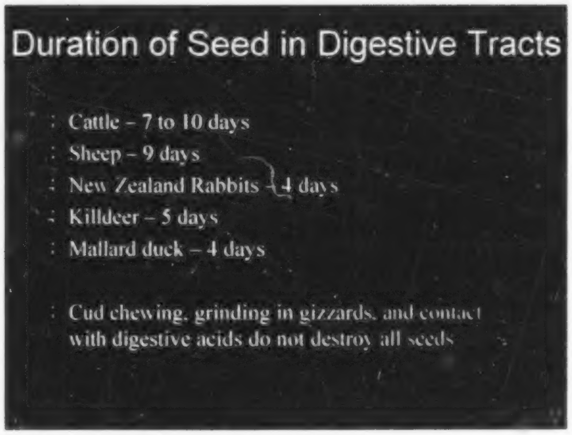

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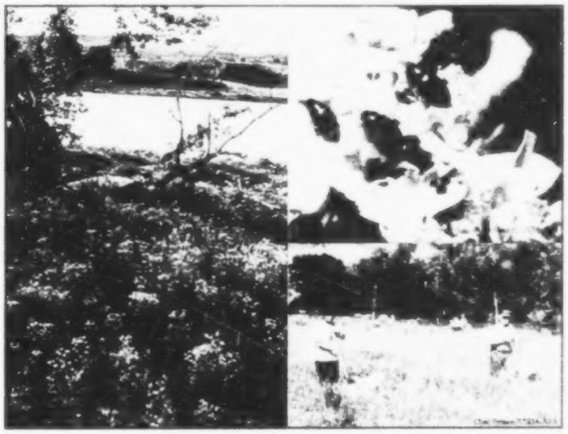
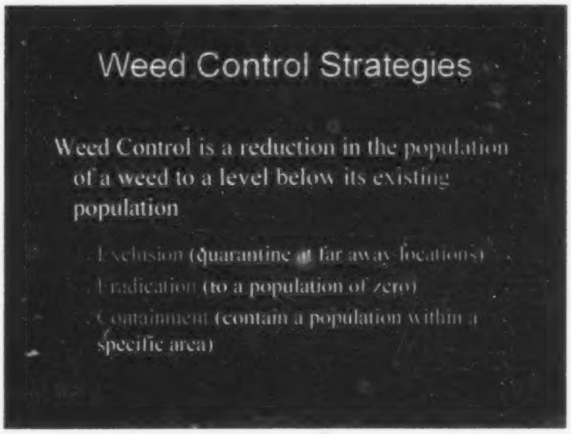
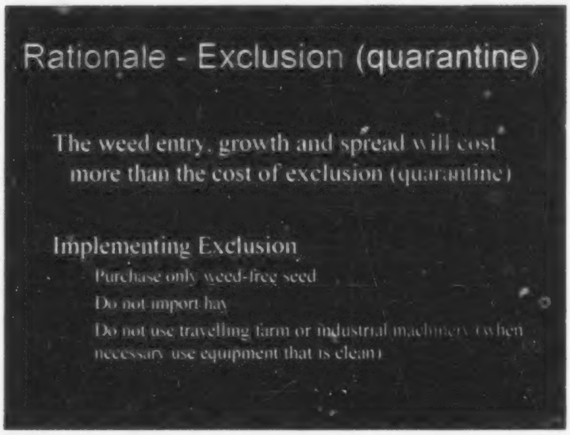




Weed Control Strategies

Weed Control is a reduction in the population of a weed to a level below its existing population

- Exclusion (quarantine at far away locations)
- Eradication (to a population of zero)
- Containment (contain a population within a specific area)

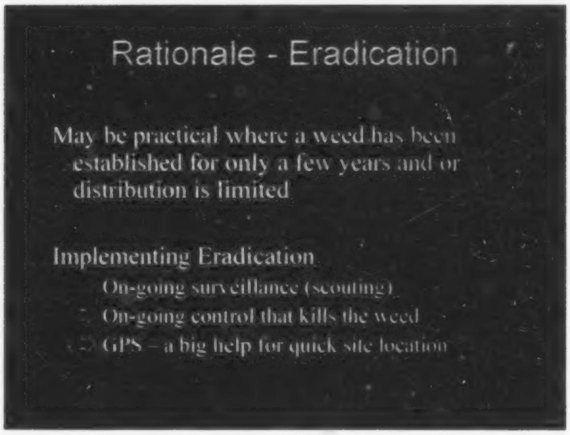


Rationale - Exclusion (quarantine)

The weed entry, growth and spread will cost more than the cost of exclusion (quarantine)

Implementing Exclusion

- Purchase only weed-free seed
- Do not import hay
- Do not use travelling farm or industrial machinery (when necessary use equipment that is clean)

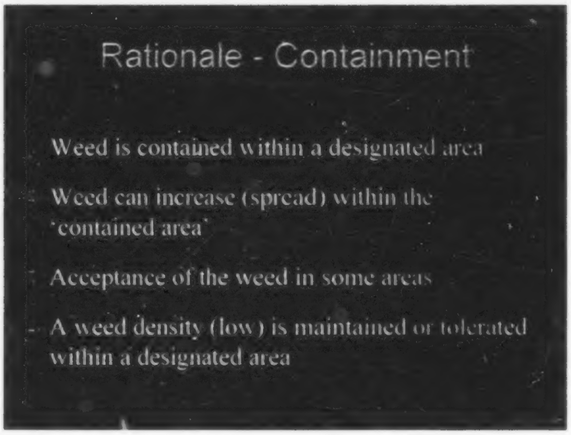


Rationale - Eradication

May be practical where a weed has been established for only a few years and/or distribution is limited

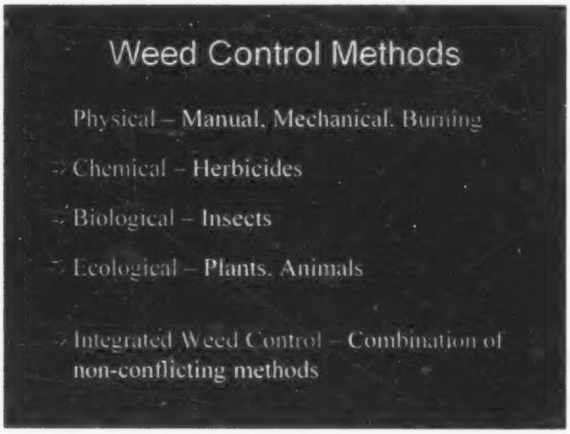
Implementing Eradication

- On-going surveillance (scouting)
- On-going control that kills the weed
- GPS – a big help for quick site location



Rationale - Containment

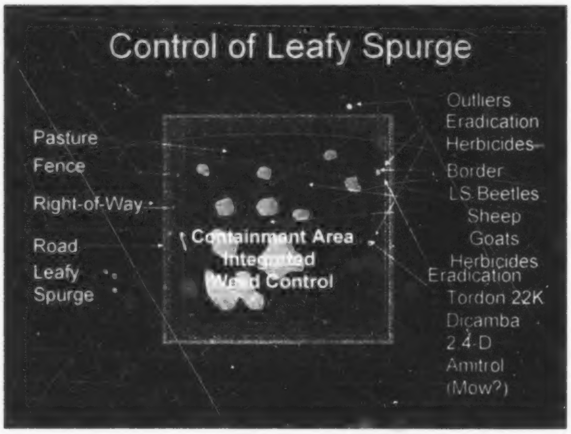
- Weed is contained within a designated area
- Weed can increase (spread) within the 'contained area'
- Acceptance of the weed in some areas
- A weed density (low) is maintained or tolerated within a designated area



Weed Control Methods

- Physical – Manual, Mechanical, Burning
- Chemical – Herbicides
- Biological – Insects
- Ecological – Plants, Animals

- Integrated Weed Control – Combination of non-conflicting methods



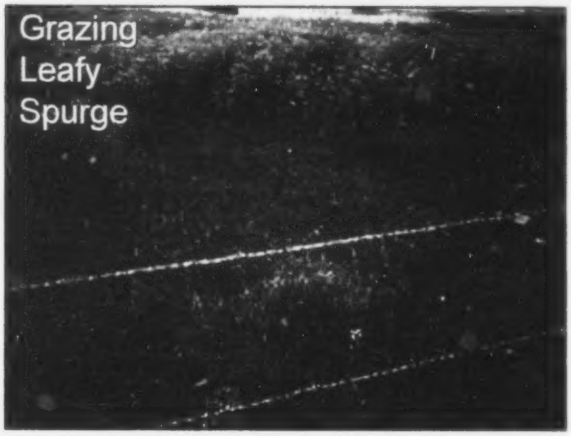
Control of Leafy Spurge

Pasture
Fence
Right-of-Way
Road
Leafy
Spurge

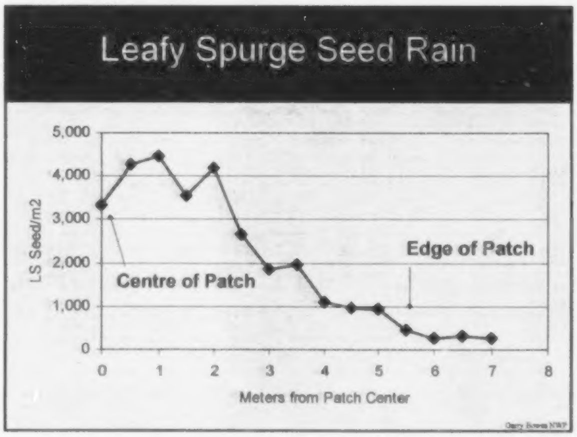
Containment Area
Integrated
Weed Control

Outliers
Eradication
Herbicides
Border
LS Beetles
Sheep
Goats
Herbicides
Eradication
Tordon 22K
Dicamba
2,4-D
Amitrol
(Mow?)

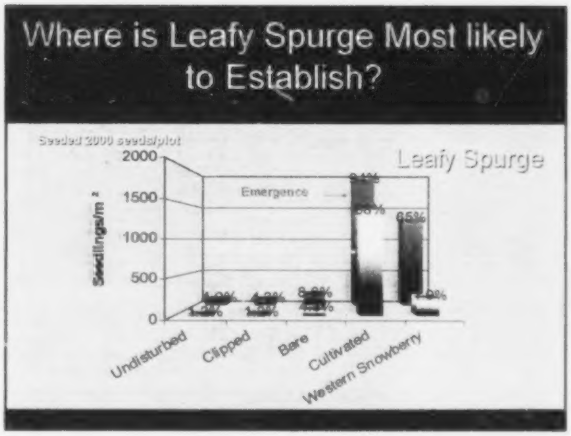
Leafy Spurge Control - Border



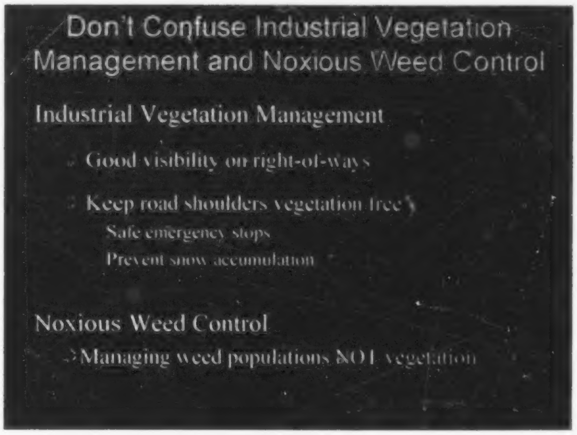
Grazing Leafy Spurge



Leafy Spurge Seed Rain



Where is Leafy Spurge Most likely to Establish?



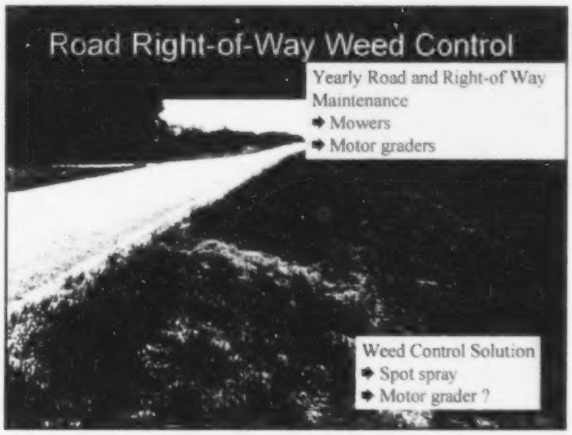
Don't Confuse Industrial Vegetation Management and Noxious Weed Control

Industrial Vegetation Management

- Good visibility on right-of-ways
- Keep road shoulders vegetation free
  - Safe emergency stops
  - Prevent snow accumulation

Noxious Weed Control

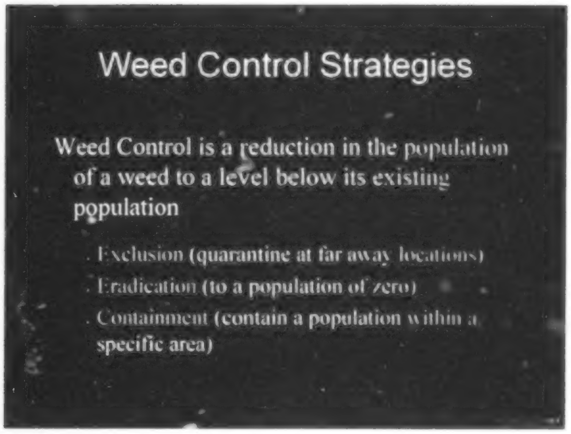
- Managing weed populations NOT vegetation



Road Right-of-Way Weed Control

Yearly Road and Right-of Way Maintenance
- Mowers
- Motor graders

Weed Control Solution
- Spot spray
- Motor grader ?



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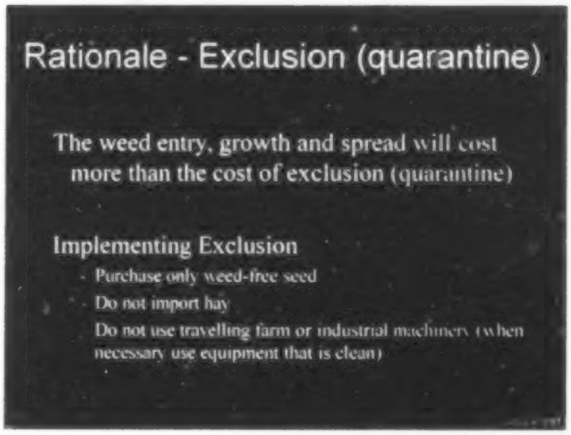

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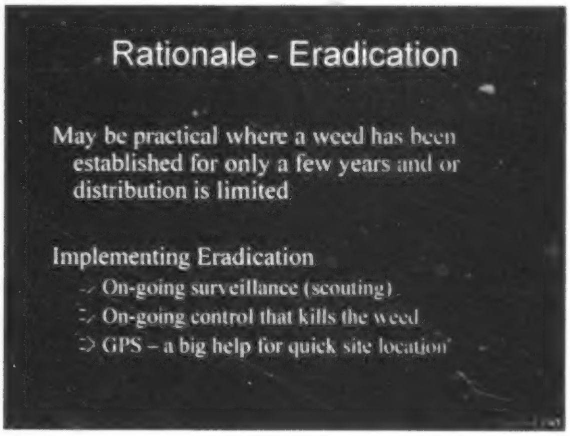

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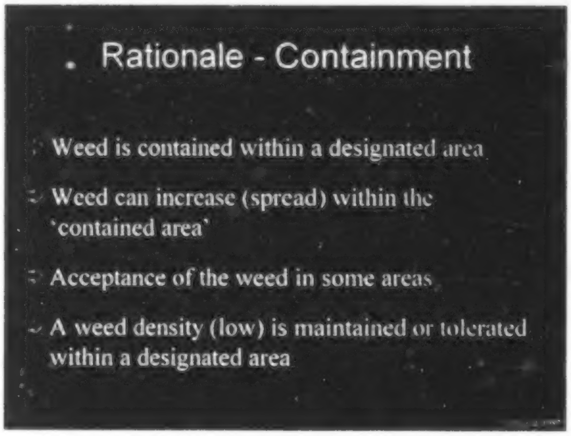

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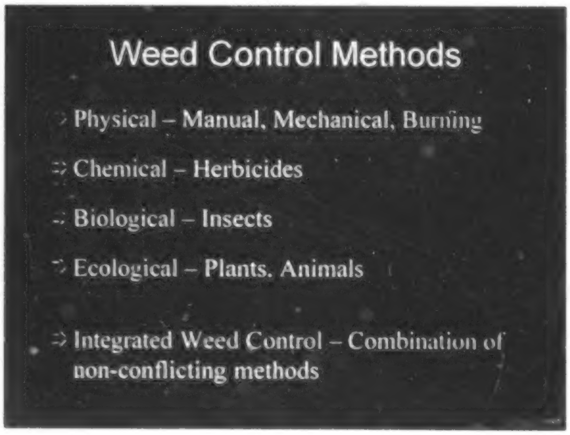

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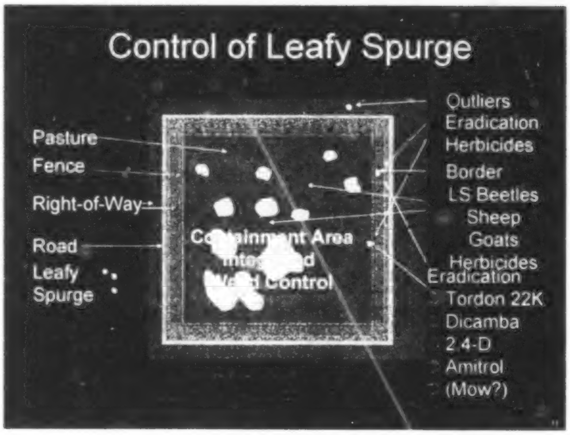

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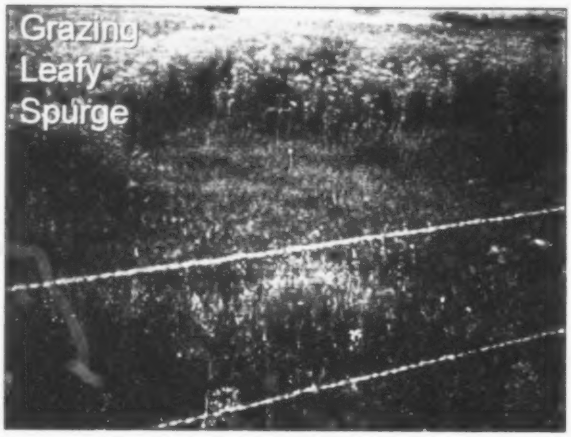
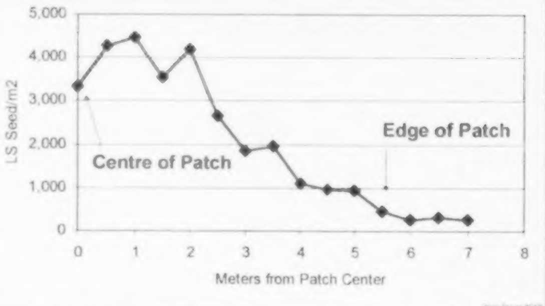
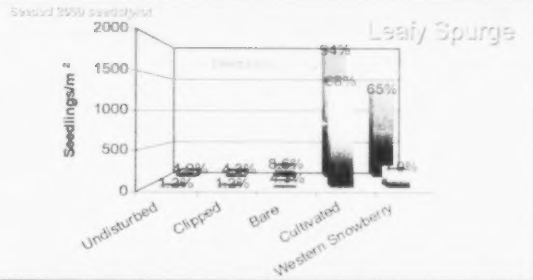
2 4-D
Amitrol
(Mow?)



Leafy Spurge Seed Rain



Where is Leafy Spurge Most likely to Establish?



Don't Confuse Industrial Vegetation Management and Noxious Weed Control

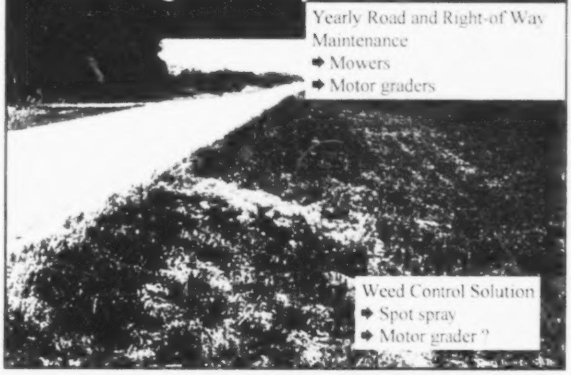
Industrial Vegetation Management

- Good visibility on right-of-ways
- Keep road shoulders vegetation free
  - Safe emergency stops
  - Prevent snow accumulation

Noxious Weed Control

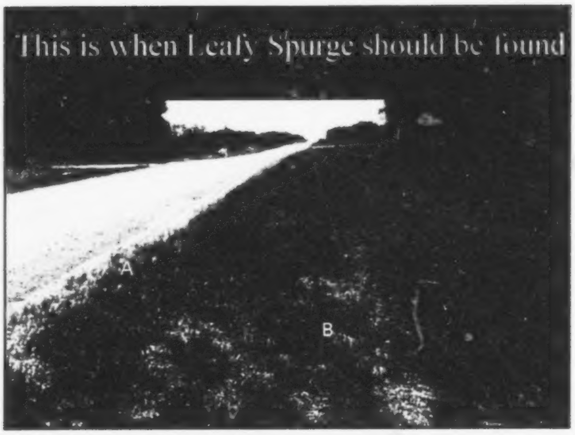
- Managing weed populations NOT vegetation

Road Right-of-Way Weed Control



Yearly Road and Right-of Way Maintenance
- Mowers
- Motor graders

Weed Control Solution
- Spot spray
- Motor grader ?



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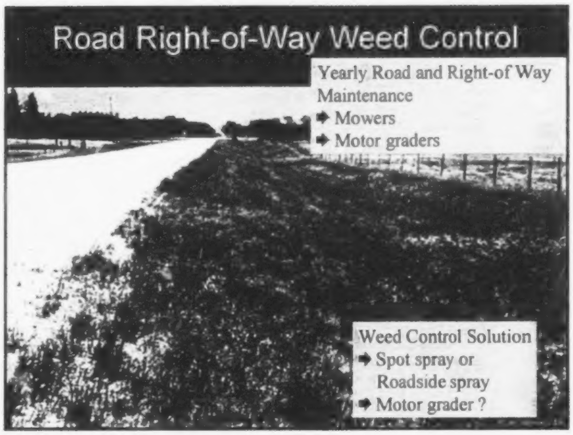

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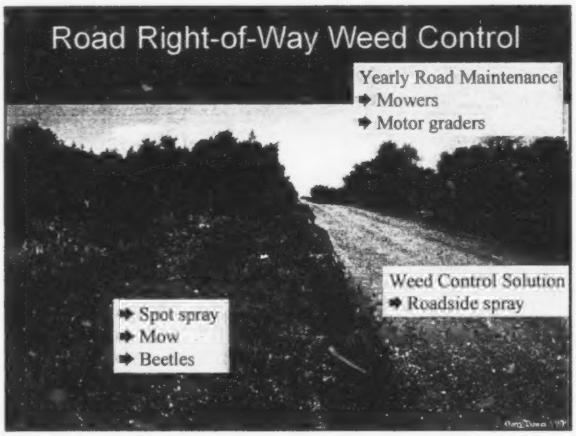

Road Right-of-Way Weed Control

Yearly Road Maintenance
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- Beetles

Road Right-of-Way Weed Control

Yearly Road Maintenance
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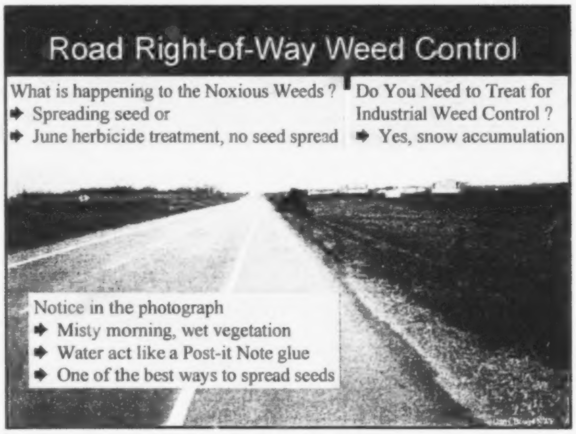
- Motor graders

Trees

- Spot spray
- Mow
- Beetles



Road Right-of-Way Weed Control

What is happening to the Noxious Weeds ?
- Spreading seed or
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Do You Need to Treat for Industrial Weed Control ?
- Yes, snow accumulation

Notice in the photograph
- Misty morning, wet vegetation
- Water act like a Post-it Note glue
- One of the best ways to spread seeds

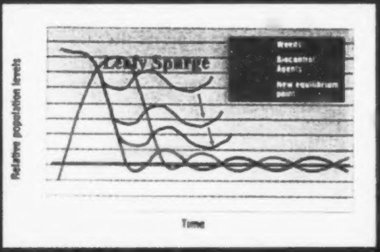
What Is Biological Control?

Biological control covers two key concepts:

→ the deliberate use of a weed's "natural enemies" to suppress its population

the use of these live organisms to maintain this lower population density

How Does Biological Control Work? Population Suppression



Types of Biocontrol Agents

Root feeders
  - Black dot (*Aphthona nigriscutis*)
  - Brown dot (*A. cyparissiae*)
  - Black (*A. lacertosa*) – brown rear upper leg
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  - Released in prairies 1965 (MT 1985?)

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  - Spurge hawk moth (*Hyles euphorbiae*)
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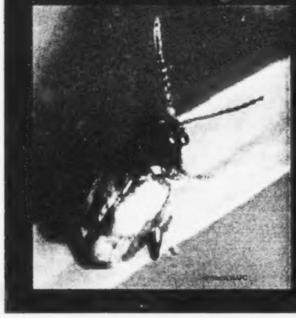
  - Since 2002, in southern AB, SK (from MT?), (US virus disease)

Black dot spurge flea beetle (*Aphthona nigriscutis*)



- Release 1000+ beetles per release point
- Coarse dry to very dry soils
- Soil warmed by aspect or lack ground cover
- Spurge density <60/m²

Brown dot spurge flea beetle (*Aphthona cyparissiae*)

- Release 1000+ beetles per release point
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- Soil sand content 40 – 60%
- Green needle grass – Kentucky blue grass

Black spurge flea beetle (*Aphthona lacertosa*)

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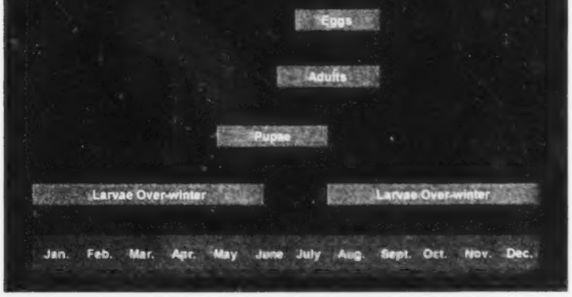
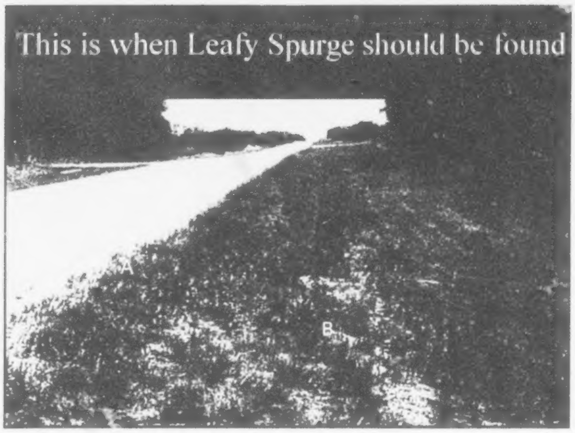
Leafy Spurge Beetles (*Aphthona*) **Life Cycle**





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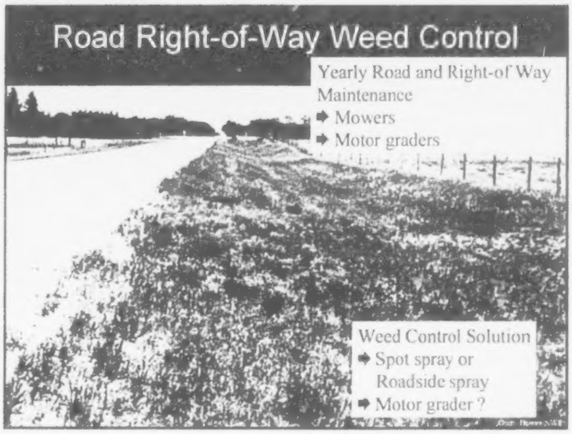

Road Right-of-Way Weed Control

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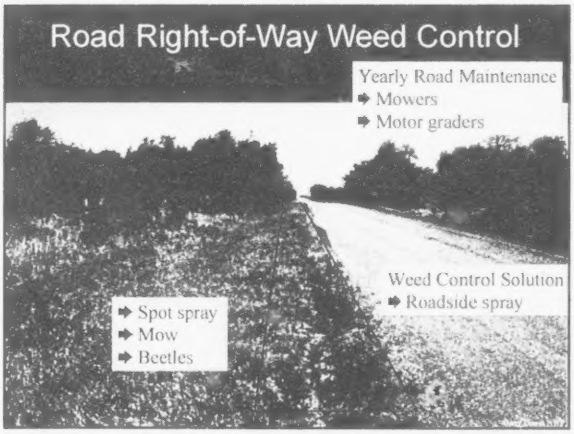

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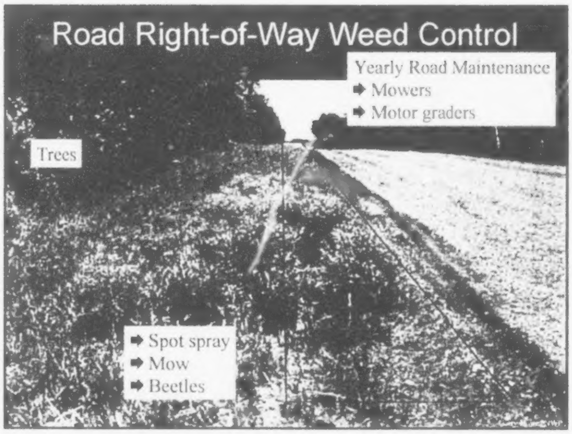

Road Right-of-Way Weed Control

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Trees

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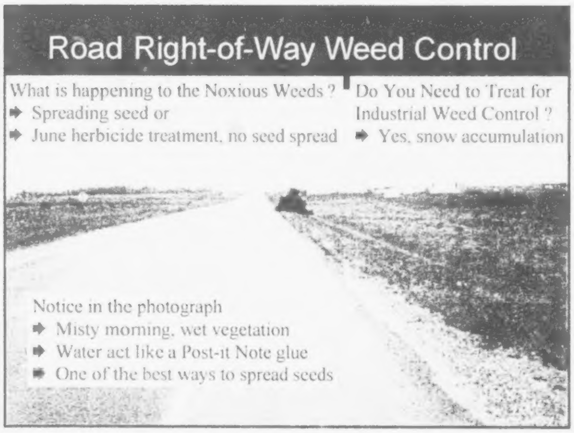
- Mow
- Beetles



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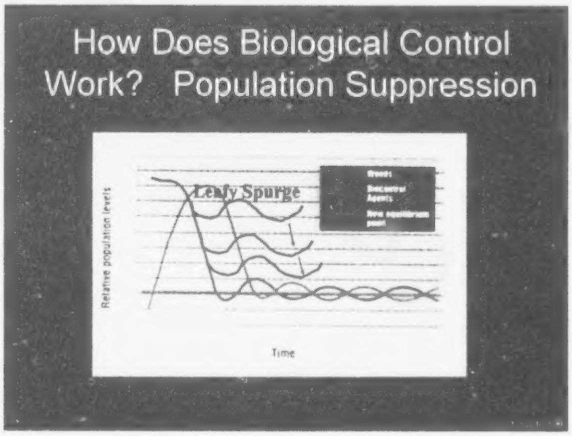

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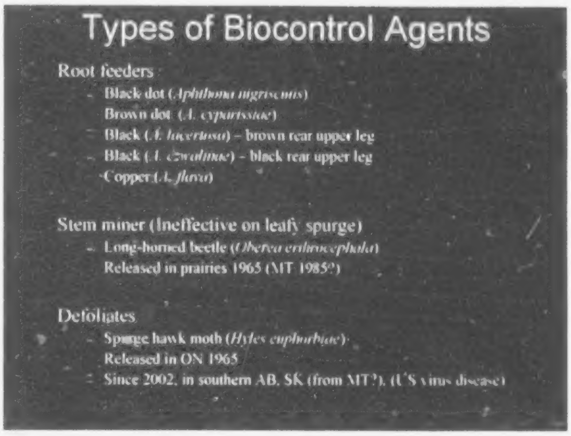

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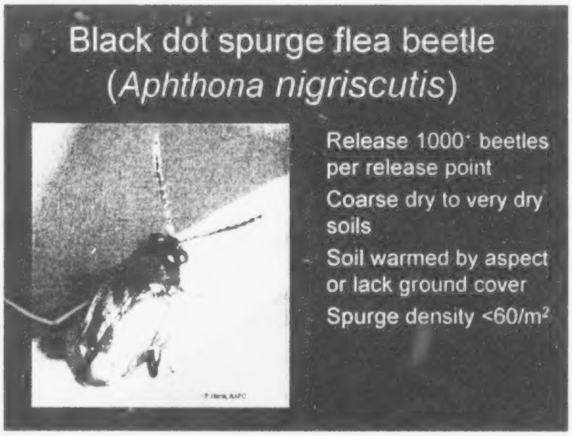

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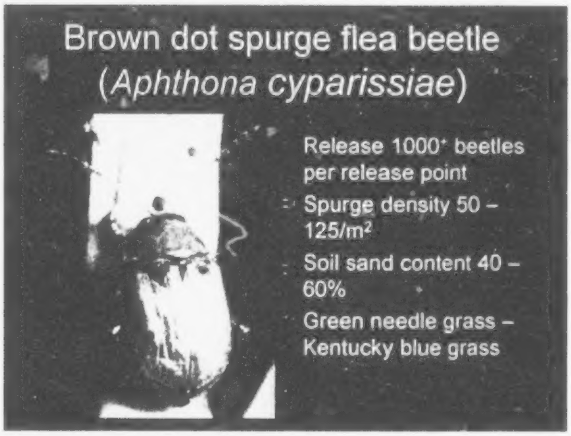

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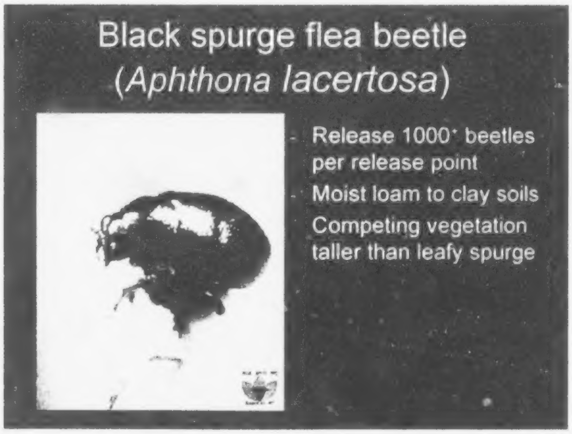

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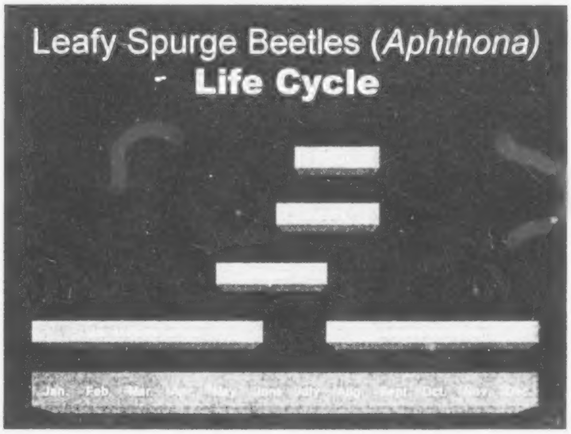
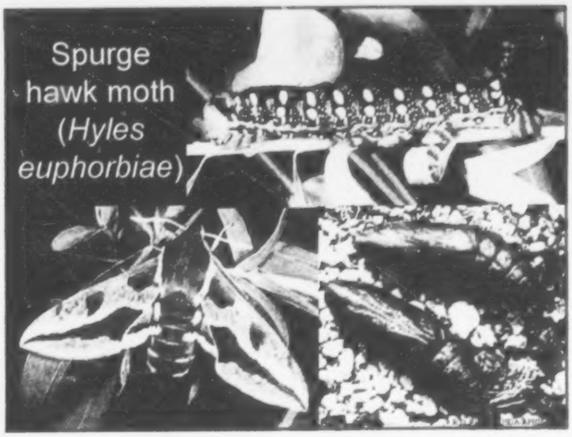


Leafy Spurge Beetles (*Aphthona*) - **Life Cycle**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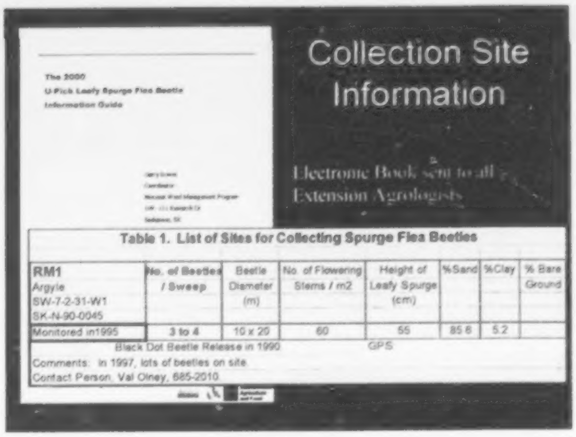
Collection Site Information

Electronic Book sent to all Extension Agrologists

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U-Pick Leafy Spurge Flea Beetle
Information Guide

Table 1. List of Sites for Collecting Spurge Flea Beetles

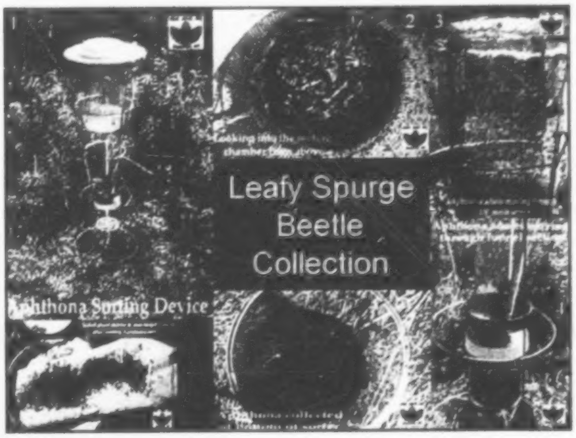
RM1 Argyle SW-7-2-31-W1 SK-N-90-0045	No. of Beetles / Sweep	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in1995	3 to 4	10 x 20	60	55	85.6	5.2	

Black Dot Beetle Release in 1990 GPS

Comments: In 1997, lots of beetles on site

Contact Person. Val Olney, 685-2010

Leafy Spurge Beetle Collection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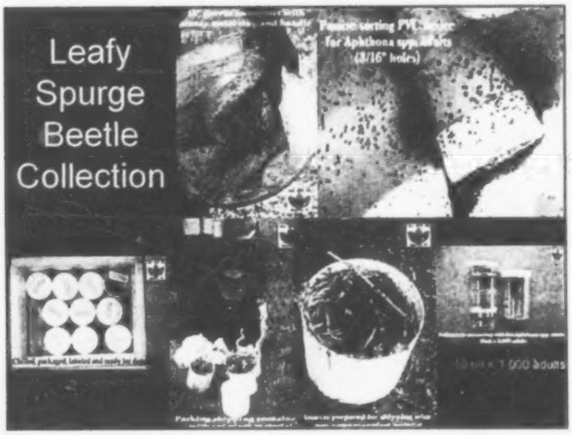
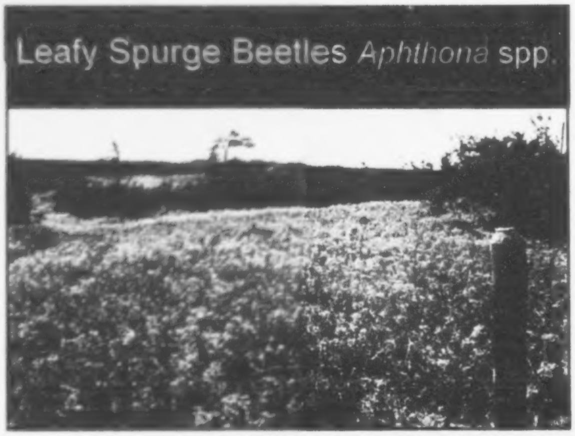

Leafy Spurge Beetle Collection

Passive sorting PVC device for Aphthona spp. adults (3/16" holes)
Chilled, packaged, labeled and ready for [illegible]
10 ml = 1,000 adults

Leafy Spurge Control - Ring

- Leafy spurge control in a ring around the release point
- Collect from 'hot spots'



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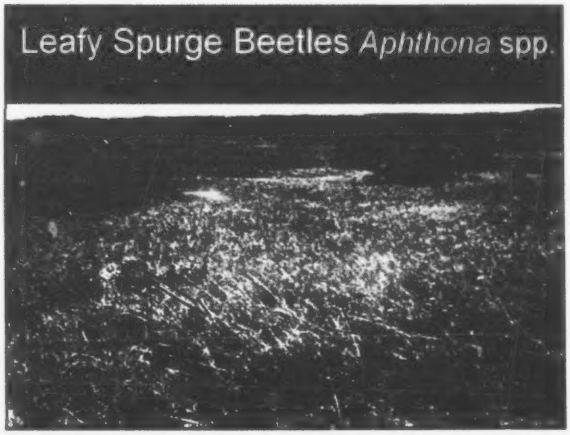

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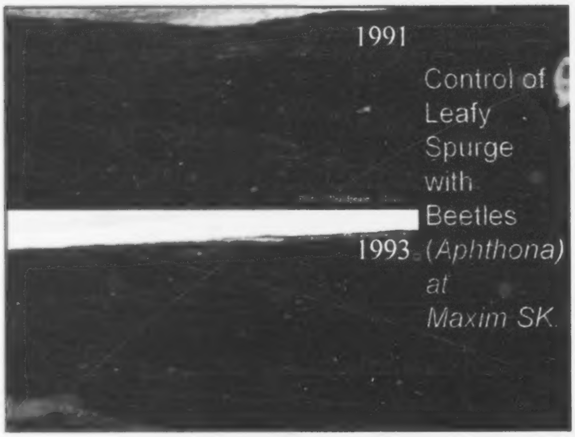
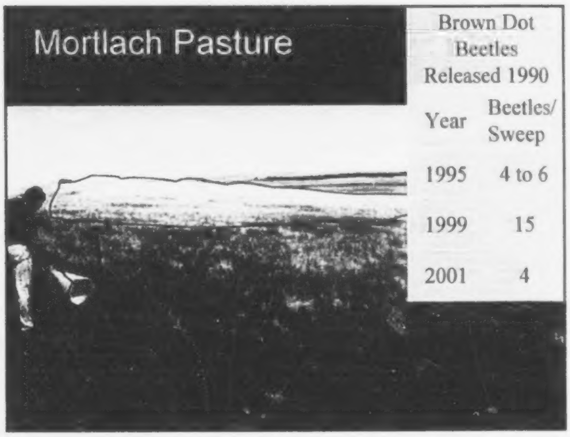


1991

1993

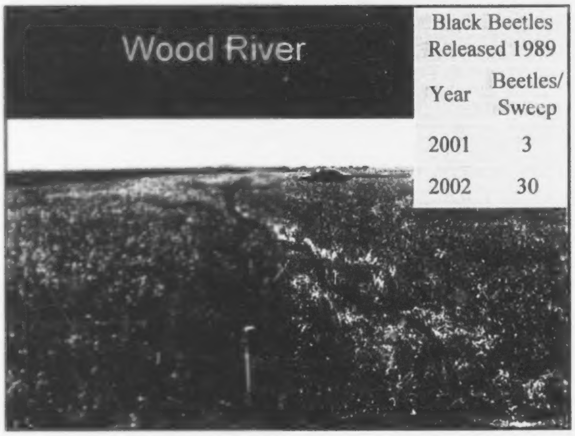
Control of Leafy Spurge with Beetles *(Aphthona)* at Maxim SK.



Mortlach Pasture

Brown Dot Beetles Released 1990

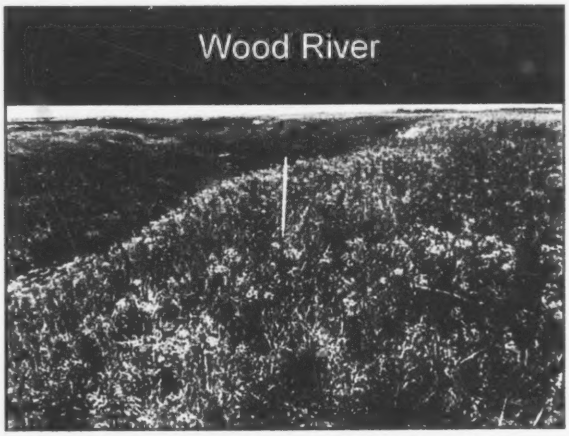
Year	Beetles/ Sweep
1995	4 to 6
1999	15
2001	4



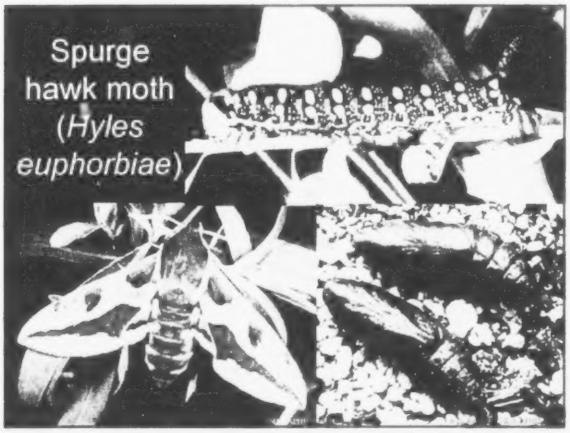
Wood River

Black Beetles Released 1989

Year	Beetles/ Sweep
2001	3
2002	30



Wood River



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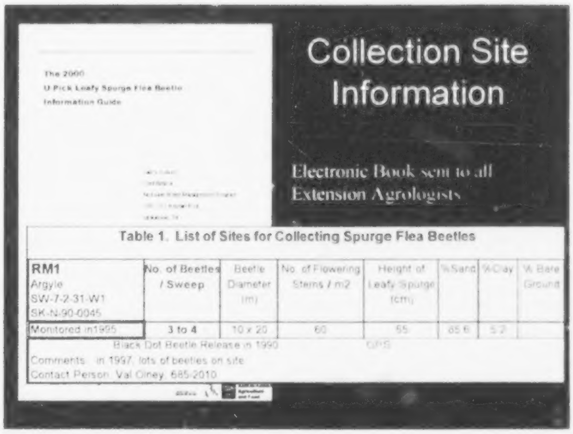

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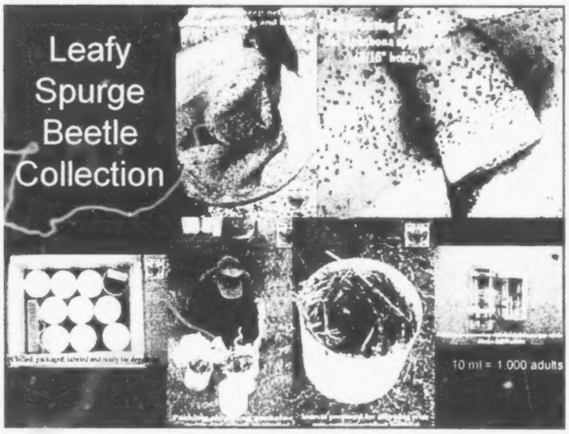

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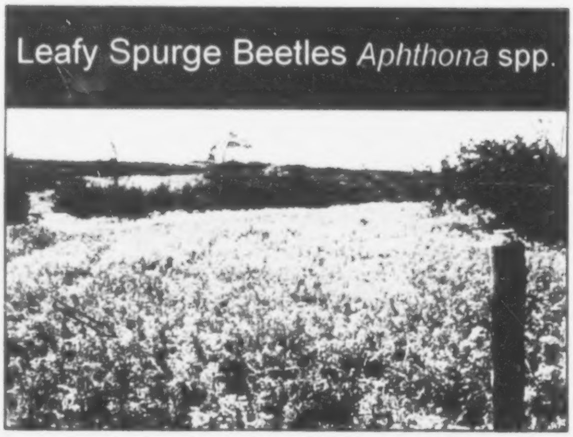
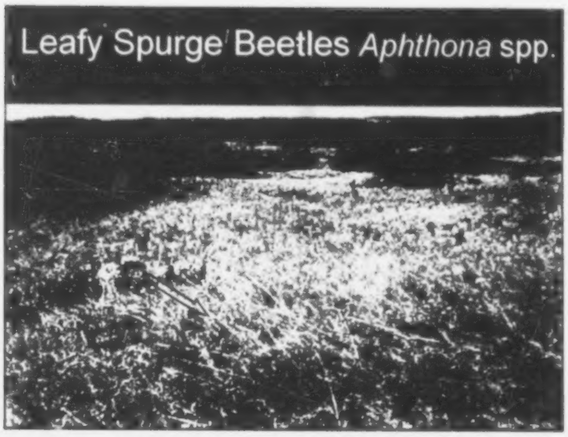


Leafy Spurge Beetles *Aphthona* spp.



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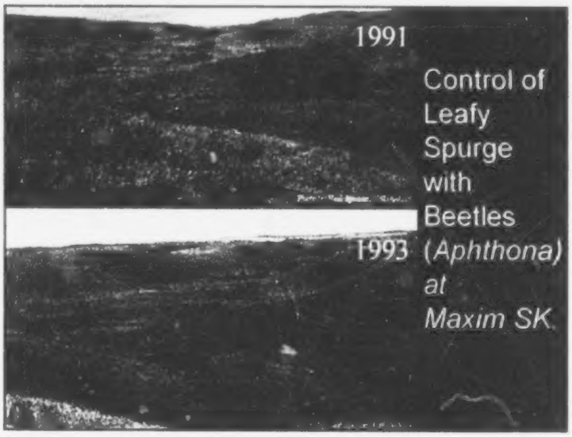

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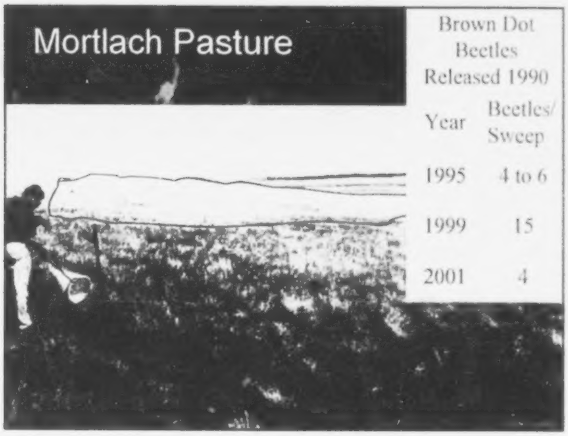

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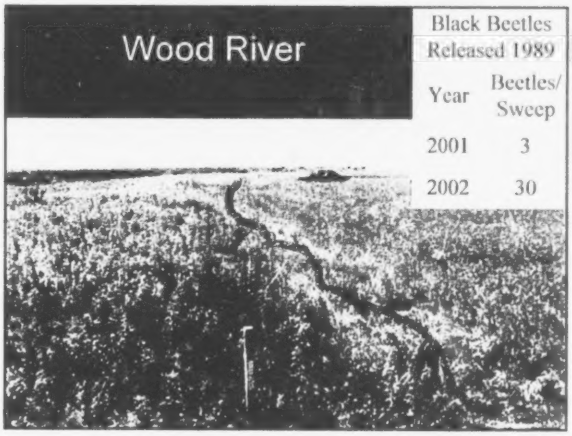

Wood River

Black Beetles Released 1989

Year	Beetles/ Sweep
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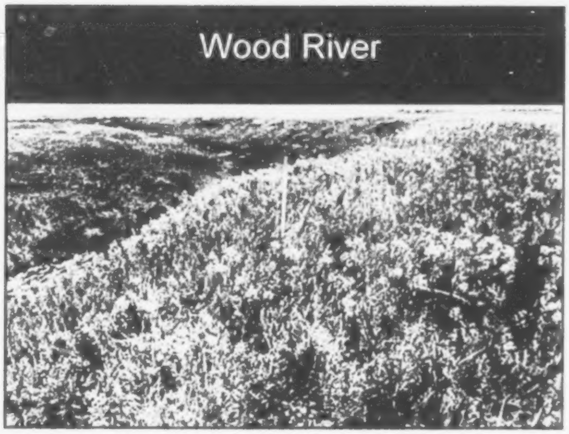
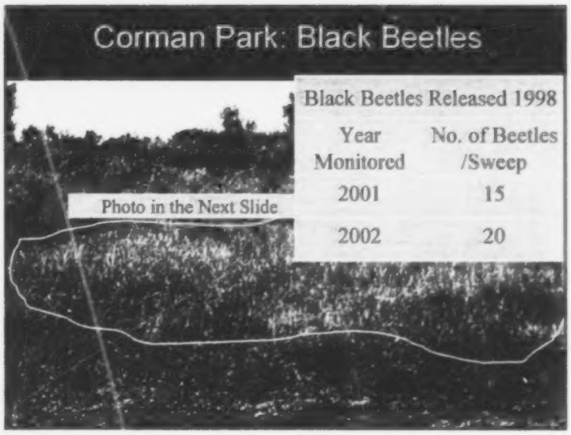


Wood River

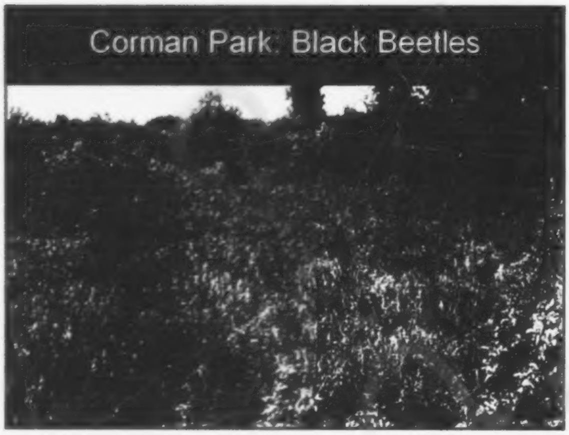
Last Mountain House Provincial Park

Last Mountain House Provincial Park



Corman Park: Black Beetles

Black Beetles Released 1998	
Year Monitored	No. of Beetles /Sweep
2001	15
2002	20



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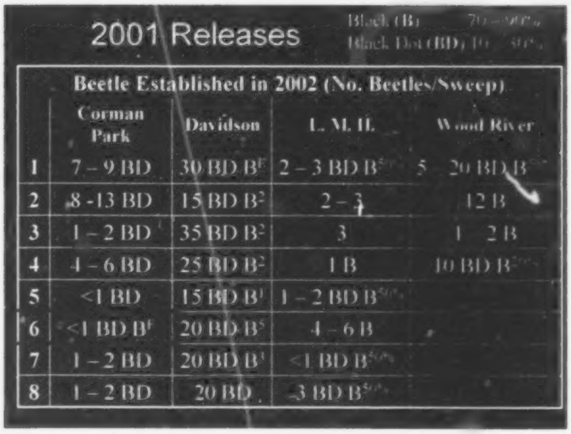
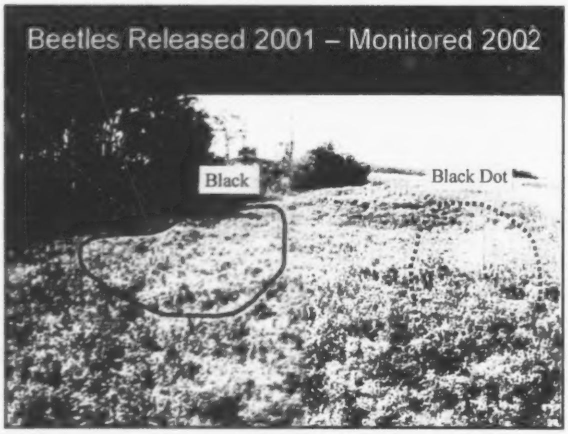


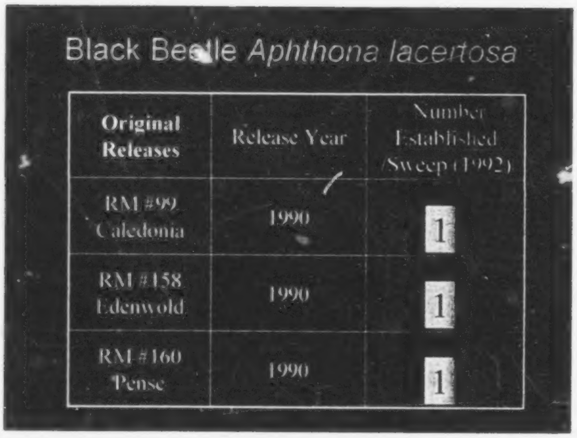
2001 Releases

Black (B) 70 – 90%
Black Dot (BD) 10 – 30%

Beetle Established in 2002 (No. Beetles/Sweep)				
	Corman Park	Davidson	L. M. H.	Wood River
1	7 – 9 BD	30 BD B^{F}	2 – 3 BD $B^{50\%}$	5 – 20 BD B[illegible]
2	8 -13 BD	15 BD B^{2}	2 – 3	12 B
3	1 – 2 BD	35 BD B^{2}	3	1 – 2 B
4	4 – 6 BD	25 BD B^{2}	1 B	10 BD $B^{50\%}$
5	<1 BD	15 BD B^{1}	1 – 2 BD $B^{50\%}$	
6	<1 BD B^{F}	20 BD B^{5}	4 – 6 B	
7	1 – 2 BD	20 BD B^{3}	<1 BD $B^{50\%}$	
8	1 – 2 BD	20 BD	3 BD $B^{50\%}$	

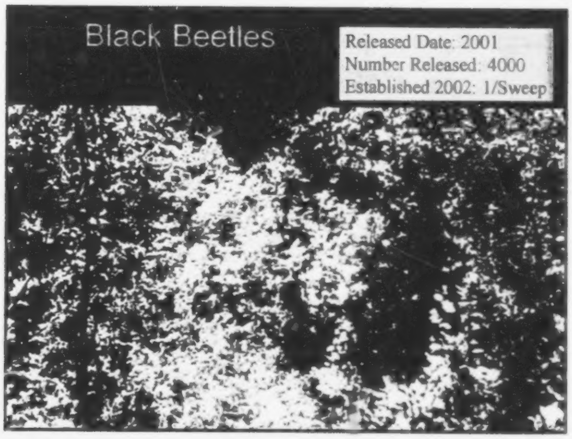


Beetles Released 2001 – Monitored 2002



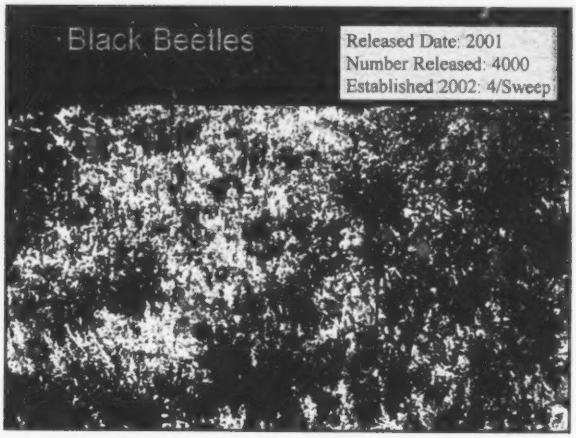
Black Beetle *Aphthona lacertosa*

Original Releases	Release Year	Number Established /Sweep (1992)
RM #99 Caledonia	1990	1
RM #158 Edenwold	1990	1
RM #160 Pense	1990	1



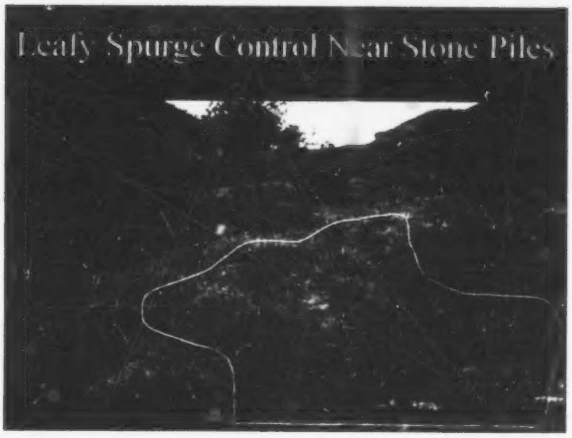
Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 1/Sweep

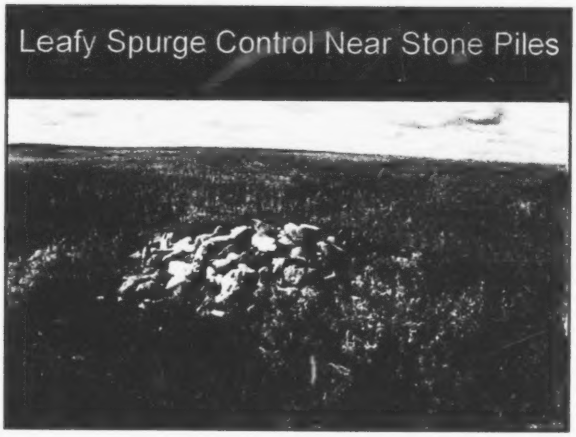


Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 4/Sweep



Leafy Spurge Control Near Stone Piles



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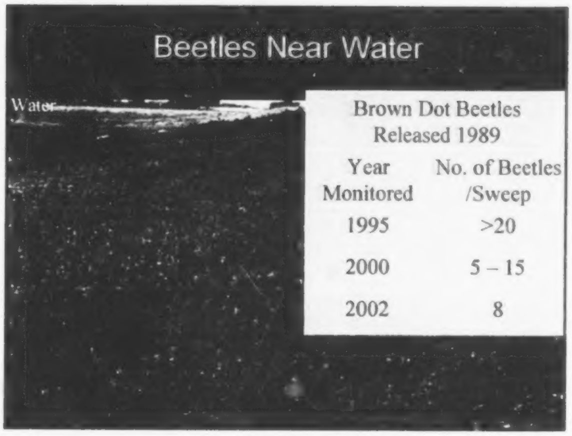
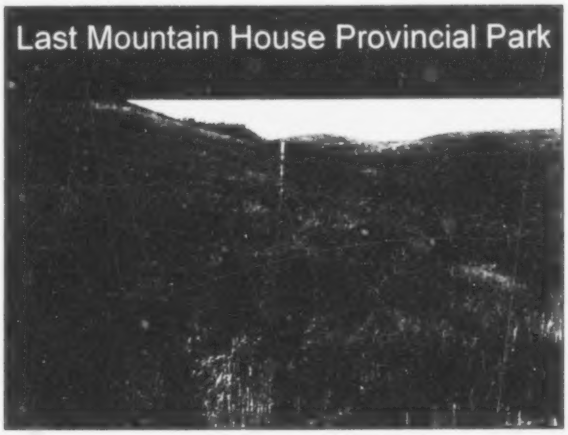


Beetles Near Water

Brown Dot Beetles
Released 1989

Year Monitored	No. of Beetles /Sweep
1995	>20
2000	5 – 15
2002	8

Last Mountain House Provincial Park



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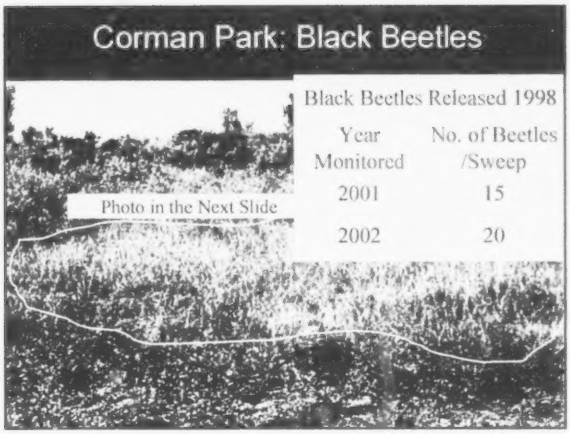
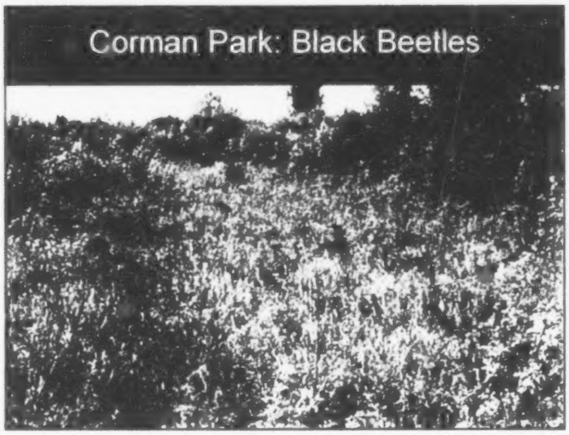
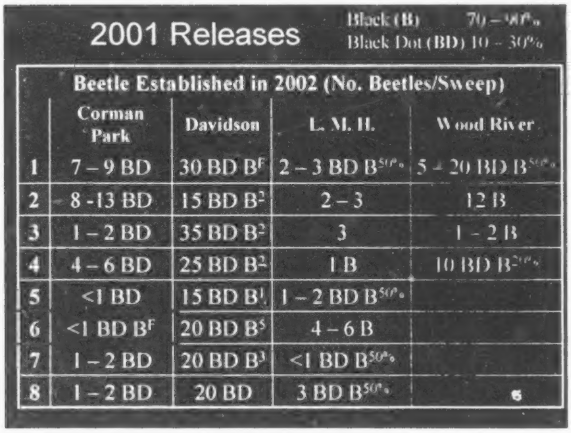


Corman Park: Black Beetles

Black Beetles Released 1998	
Year Monitored	No. of Beetles /Sweep
2001	15
2002	20



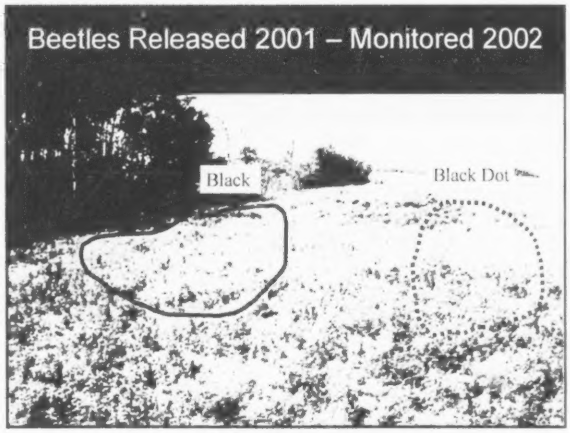
Corman Park: Black Beetles



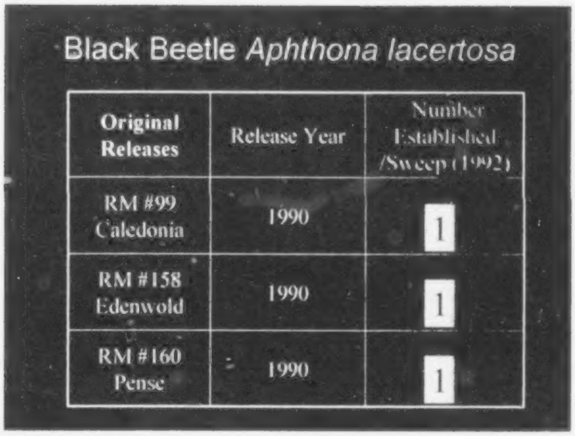
2001 Releases

Black (B) 70 – 90%
Black Dot (BD) 10 – 30%

Beetle Established in 2002 (No. Beetles/Sweep)				
	Corman Park	Davidson	L. M. H.	Wood River
1	7 – 9 BD	30 BD B^F	2 – 3 BD $B^{50\%}$	5 – 20 BD $B^{50\%}$
2	8 -13 BD	15 BD B^2	2 – 3	12 B
3	1 – 2 BD	35 BD B^2	3	1 – 2 B
4	4 – 6 BD	25 BD B^2	1 B	10 BD $B^{20\%}$
5	<1 BD	15 BD B^1	1 – 2 BD $B^{50\%}$	
6	<1 BD B^F	20 BD B^5	4 – 6 B	
7	1 – 2 BD	20 BD B^3	<1 BD $B^{50\%}$	
8	1 – 2 BD	20 BD	3 BD $B^{50\%}$	

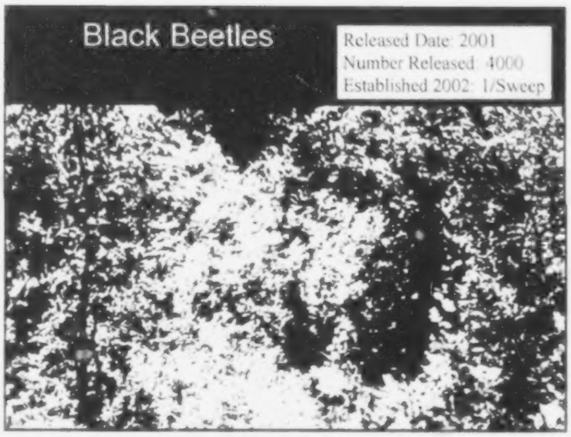


Beetles Released 2001 – Monitored 2002



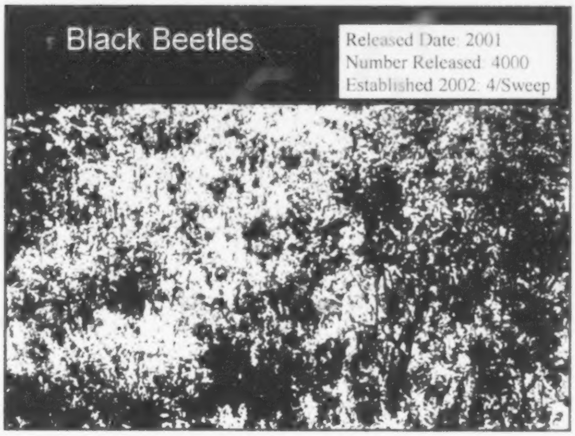
Black Beetle *Aphthona lacertosa*

Original Releases	Release Year	Number Established /Sweep (1992)
RM #99 Caledonia	1990	1
RM #158 Edenwold	1990	1
RM #160 Pense	1990	1



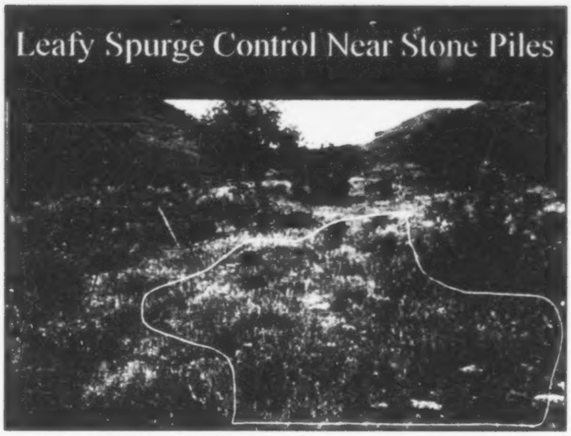
Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 1/Sweep



Black Beetles

Released Date: 2001
Number Released: 4000
Established 2002: 4/Sweep



Leafy Spurge Control Near Stone Piles

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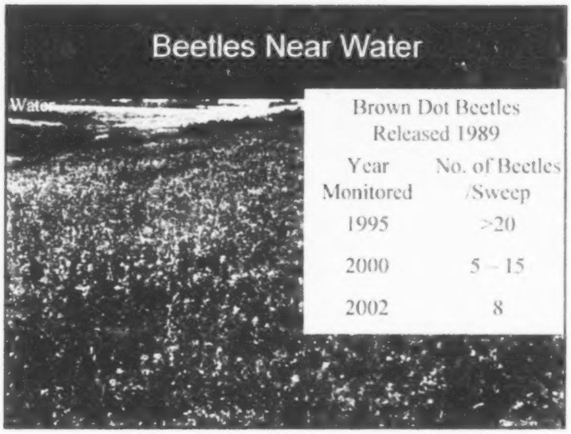

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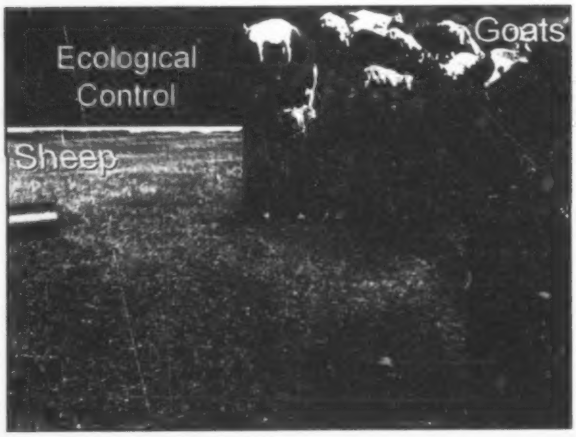
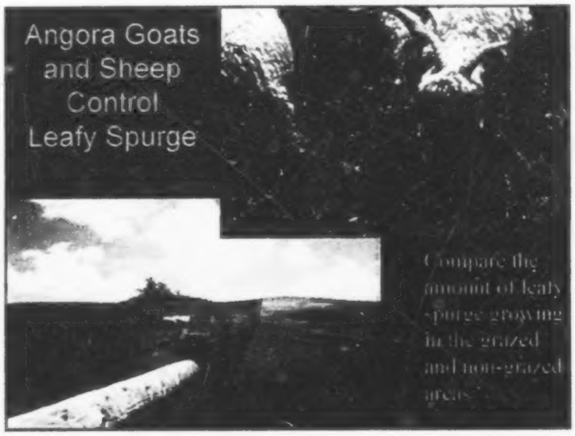
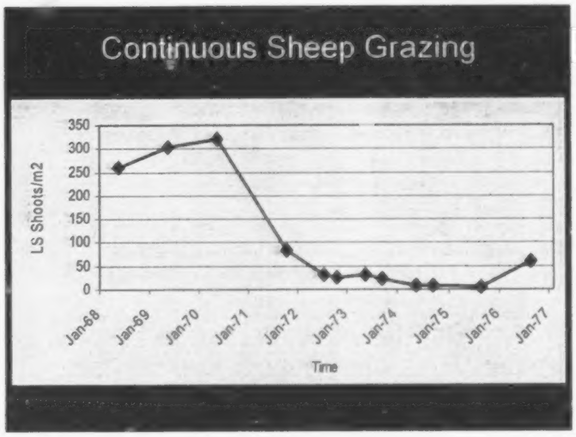


Ecological Control

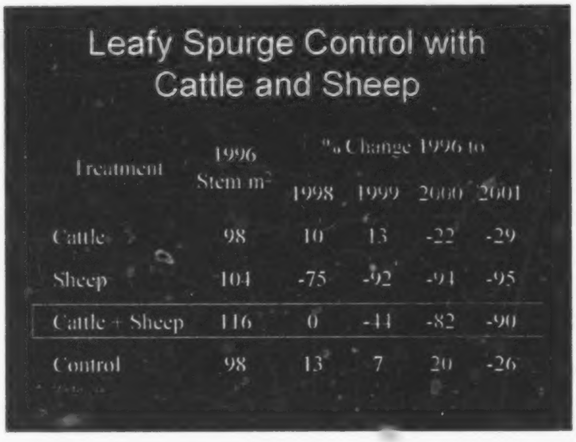


Angora Goats and Sheep Control Leafy Spurge

Compare the amount of leafy spurge growing in the grazed and non-grazed areas.

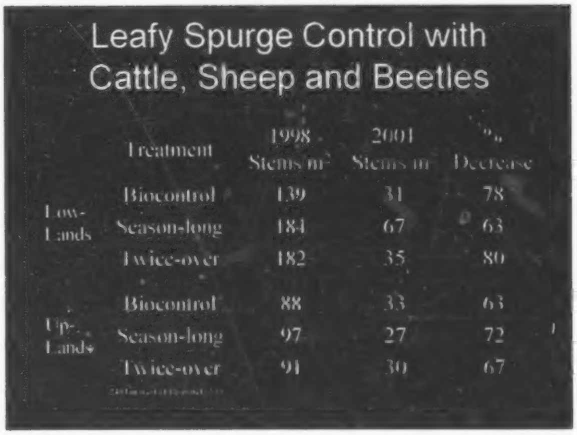


Continuous Sheep Grazing



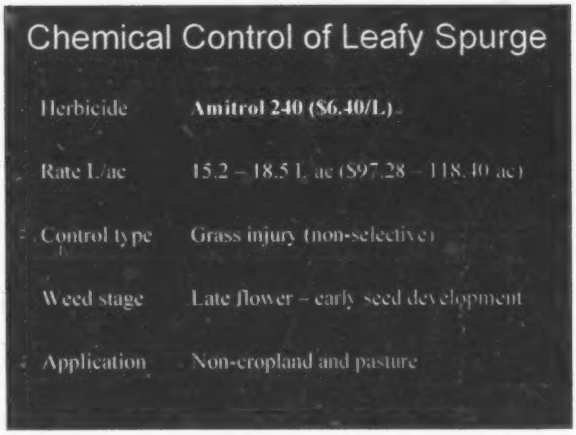
Leafy Spurge Control with Cattle and Sheep

Treatment	1996 Stem m²	% Change 1996 to			
		1998	1999	2000	2001
Cattle	98	10	13	-22	-29
Sheep	104	-75	-92	-94	-95
Cattle + Sheep	116	0	-44	-82	-90
Control	98	13	7	20	-26



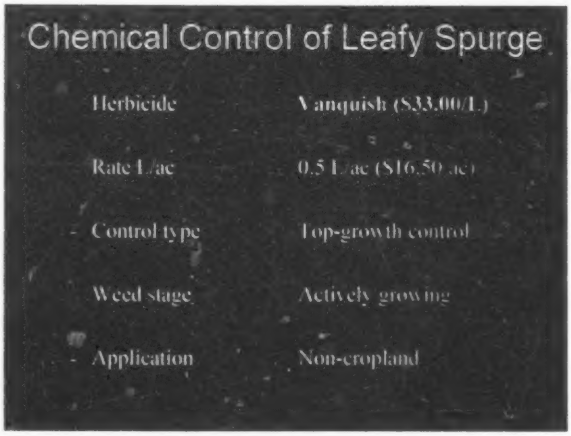
Leafy Spurge Control with Cattle, Sheep and Beetles

	Treatment	1998 Stems m²	2001 Stems m²	% Decrease
Low-Lands	Biocontrol	139	31	78
	Season-long	184	67	63
	Twice-over	182	35	80
Up-Lands	Biocontrol	88	33	63
	Season-long	97	27	72
	Twice-over	91	30	67



Chemical Control of Leafy Spurge

Herbicide	**Amitrol 240 ($6.40/L)**
Rate L/ac	15.2 – 18.5 L/ac ($97.28 – 118.40/ac)
Control type	Grass injury (non-selective)
Weed stage	Late flower – early seed development
Application	Non-cropland and pasture



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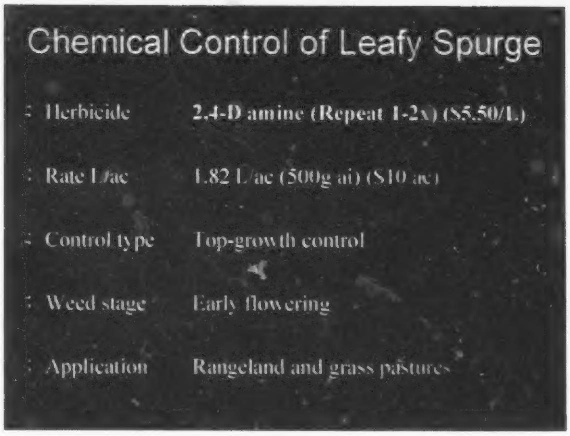
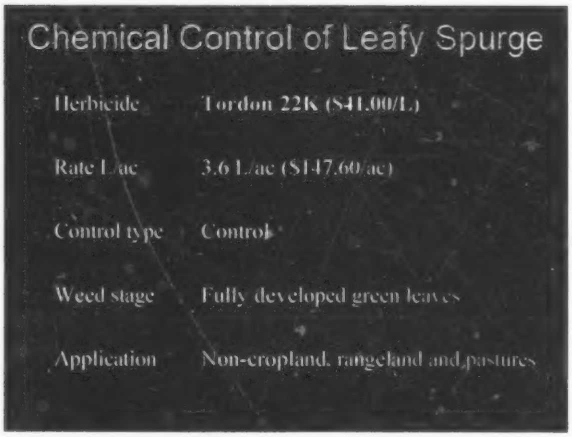
Control type	Top-growth control
Weed stage	Actively growing
Application	Non-cropland



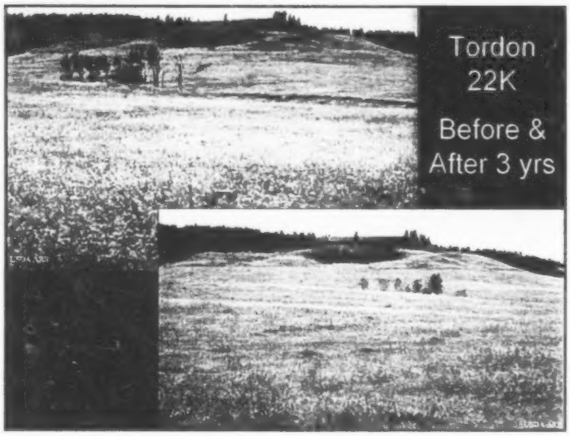
Chemical Control of Leafy Spurge

Herbicide	**2,4-D amine (Repeat 1-2x) ($5.50/L)**
Rate L/ac	1.82 L/ac (500g ai) ($10/ac)
Control type	Top-growth control
Weed stage	Early flowering
Application	Rangeland and grass pastures



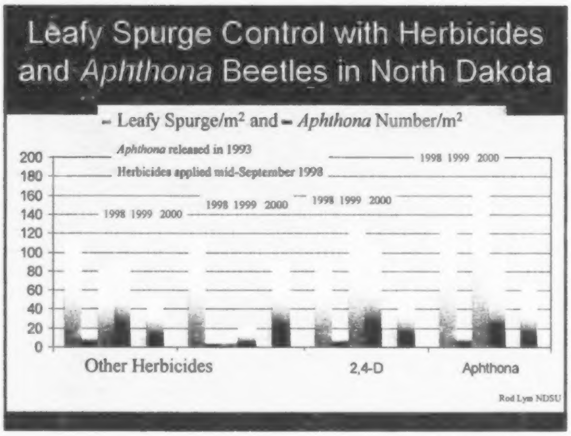
Chemical Control of Leafy Spurge

Herbicide	Tordon 22K ($41.00/L)
Rate L/ac	3.6 L/ac ($147.60/ac)
Control type	Control
Weed stage	Fully developed green leaves
Application	Non-cropland, rangeland and pastures



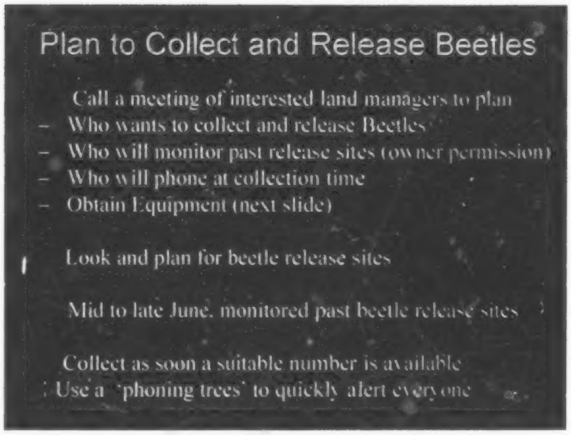
Tordon 22K

Before & After 3 yrs



Leafy Spurge Control with Herbicides and *Aphthona* Beetles in North Dakota

Rod Lym NDSU



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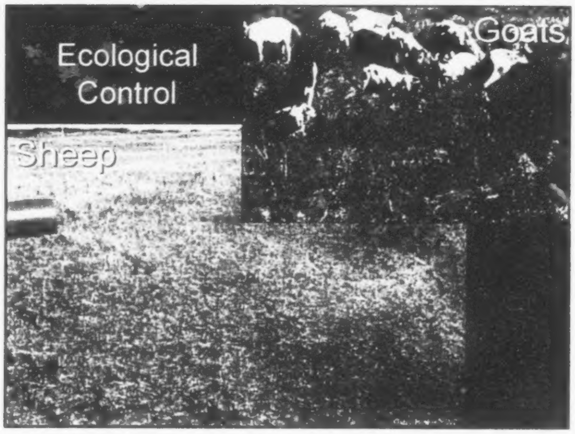
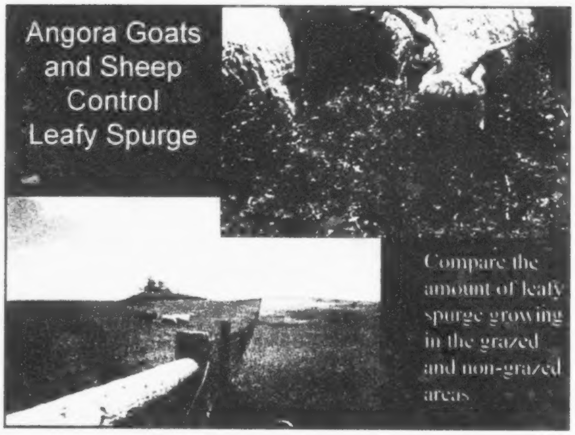


Ecological Control



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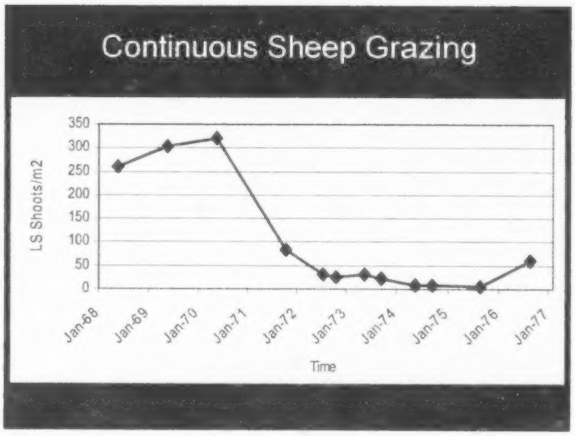
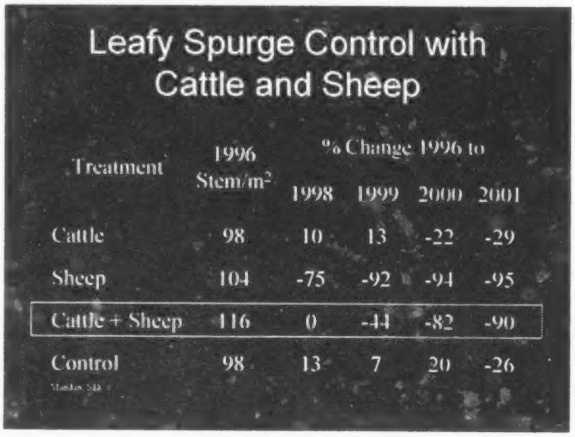


Continuous Sheep Grazing



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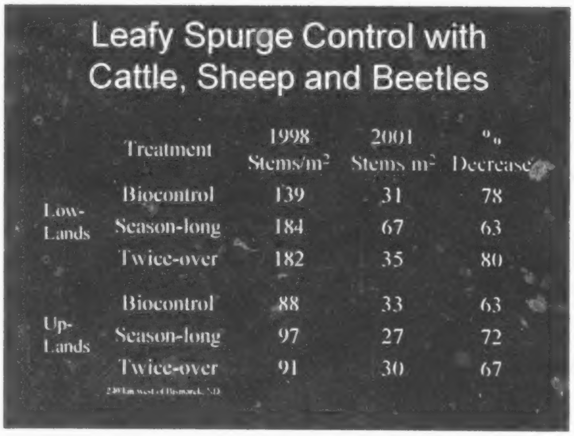
Mandan, ND



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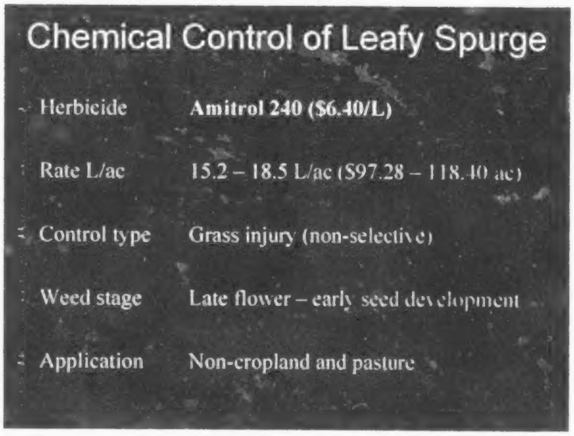
230 km west of Bismarck, ND



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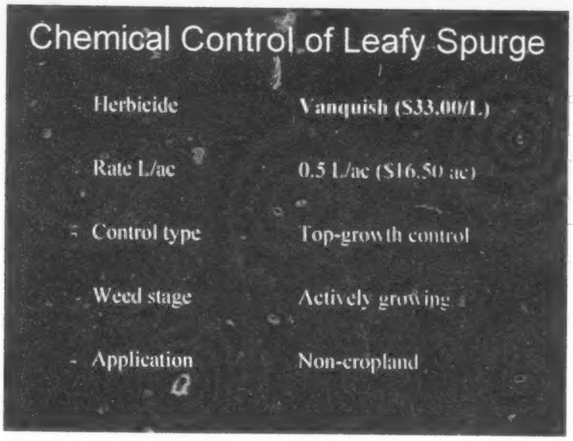

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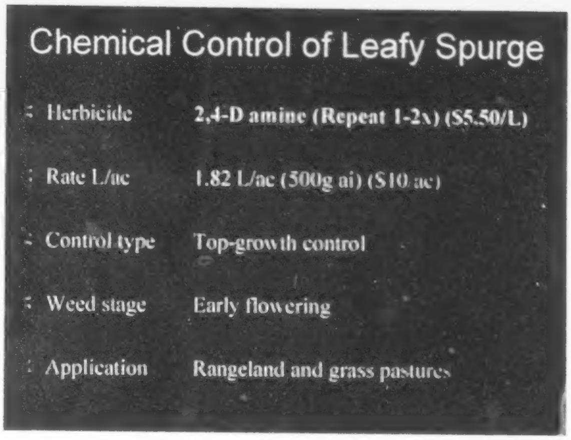

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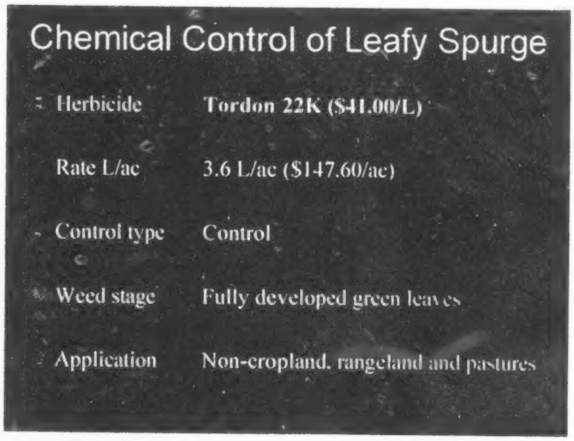

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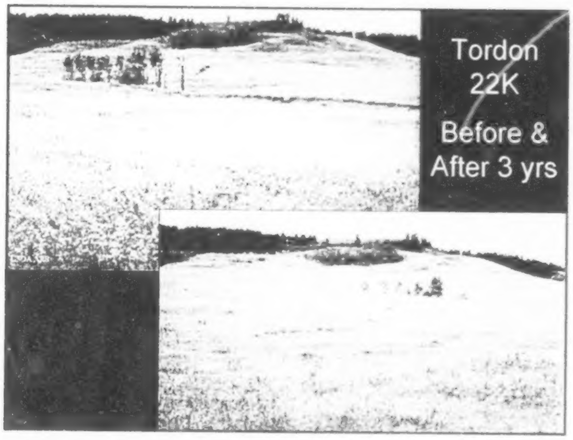

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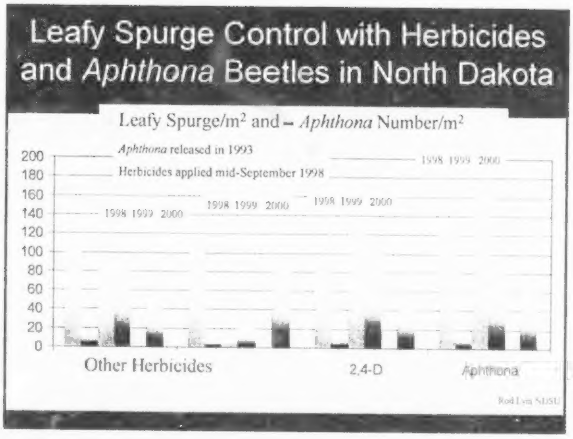

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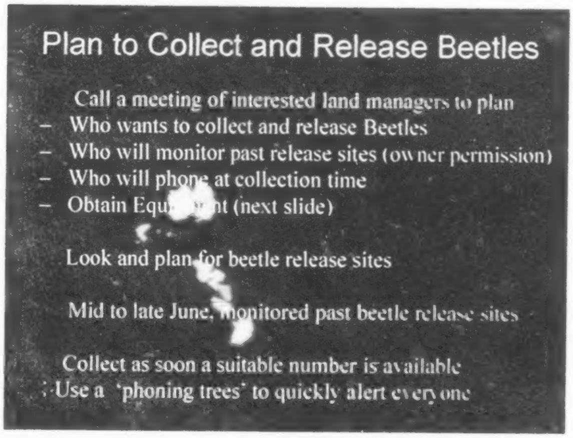

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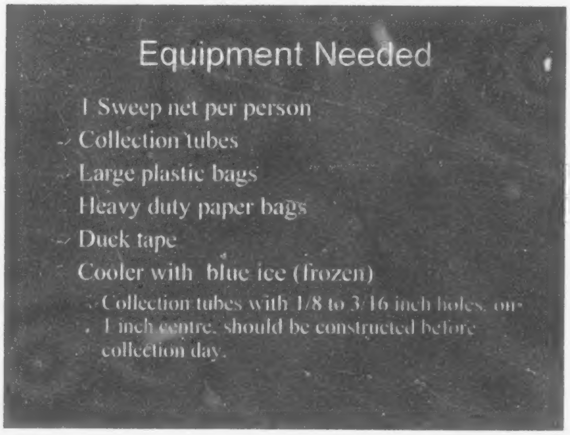
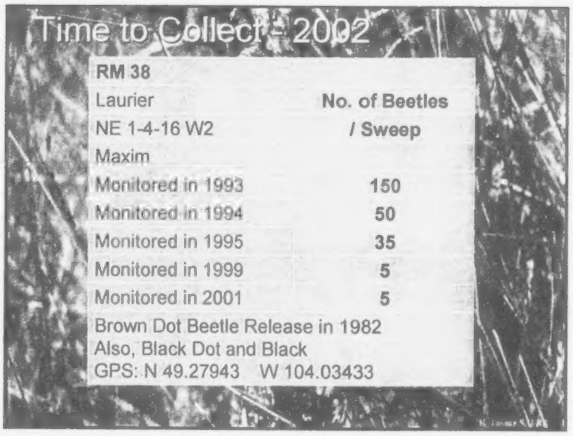


Equipment Needed

- 1 Sweep net per person
- Collection tubes
- Large plastic bags
- Heavy duty paper bags
- Duck tape
- Cooler with blue ice (frozen)
  - Collection tubes with 1/8 to 3/16 inch holes, on 1 inch centre, should be constructed before collection day.

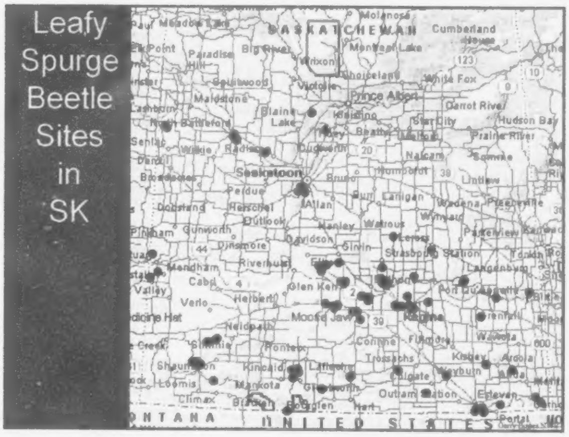


Time to Collect - 2002

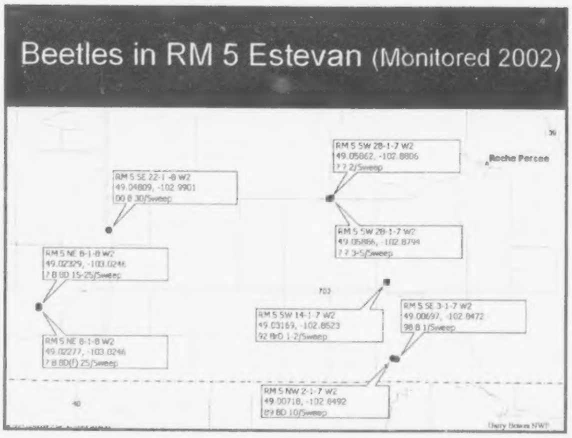
RM 38

Laurier	No. of Beetles
NE 1-4-16 W2	/ Sweep
Maxim	
Monitored in 1993	150
Monitored in 1994	50
Monitored in 1995	35
Monitored in 1999	5
Monitored in 2001	5

Brown Dot Beetle Release in 1982
Also, Black Dot and Black
GPS: N 49.27943 W 104.03433



Leafy Spurge Beetle Sites in SK



Beetles in RM 5 Estevan (Monitored 2002)

RM 5 SE 22-1-8 W2
49.04809, -102.9901
00 B 30/Sweep

RM 5 SW 28-1-7 W2
49.05862, -102.8806
? ? 2/Sweep

RM 5 SW 28-1-7 W2
49.05866, -102.8794
? ? 3-5/Sweep

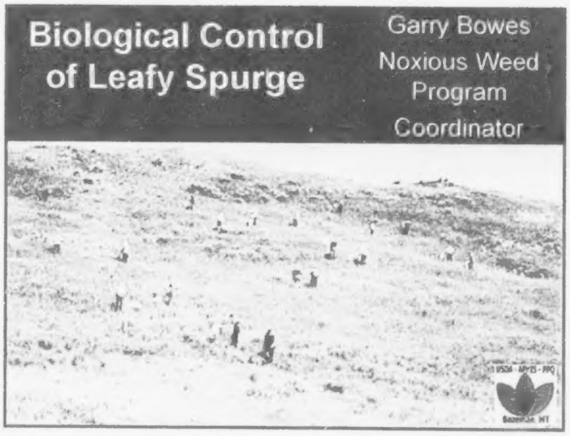
RM 5 NE 8-1-8 W2
49.02329, -103.0246
? B BD 15-25/Sweep

RM 5 NE 8-1-8 W2
49.02277, -103.0246
? B BD(f) 25/Sweep

RM 5 SW 14-1-7 W2
49.03169, -102.8523
92 BrD 1-2/Sweep

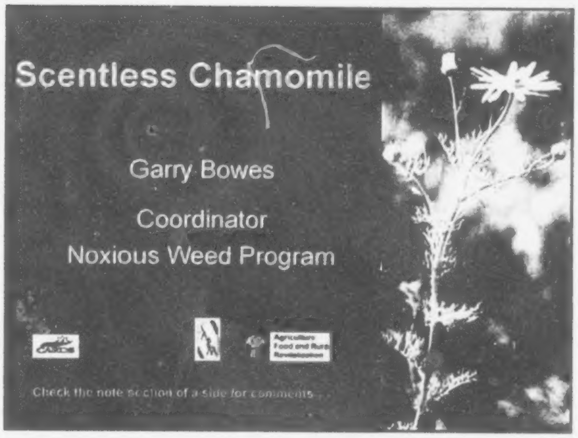
RM 5 SE 3-1-7 W2
49.00697, -102.8472
98 B 1/Sweep

RM 5 NW 2-1-7 W2
49.00718, -102.8492
89 BD 10/Sweep



Biological Control of Leafy Spurge

Garry Bowes
Noxious Weed Program Coordinator



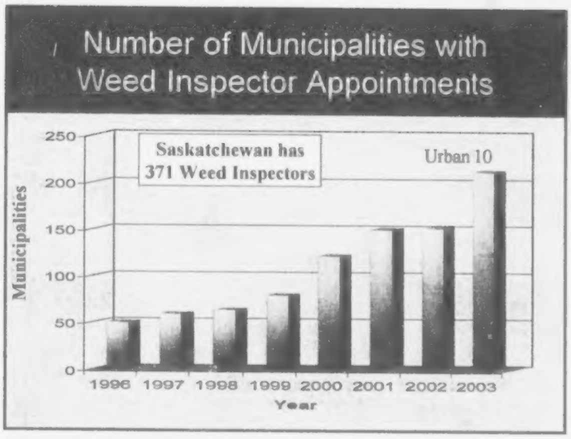
Scentless Chamomile

Garry Bowes

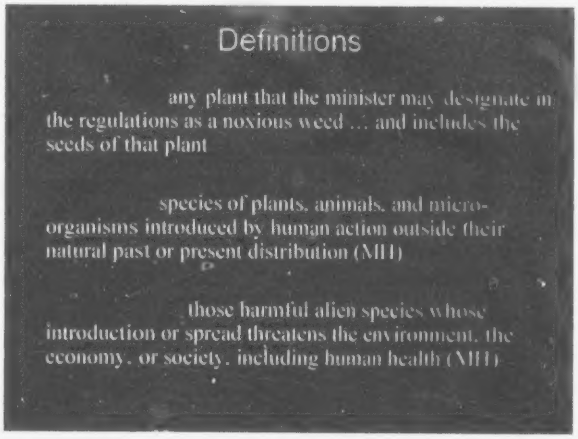
Coordinator

Noxious Weed Program

Check the note section of a slide for comments



Number of Municipalities with Weed Inspector Appointments

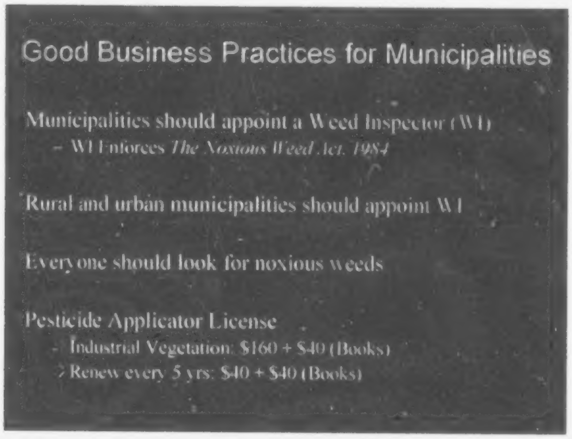


Definitions

any plant that the minister may designate in the regulations as a noxious weed … and includes the seeds of that plant

species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution (MH)

those harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health (MH)



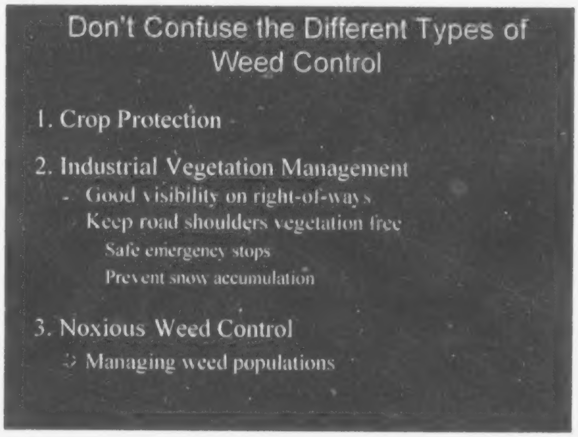
Good Business Practices for Municipalities

Municipalities should appoint a Weed Inspector (WI)
- WI Enforces *The Noxious Weed Act, 1984*

Rural and urban municipalities should appoint WI

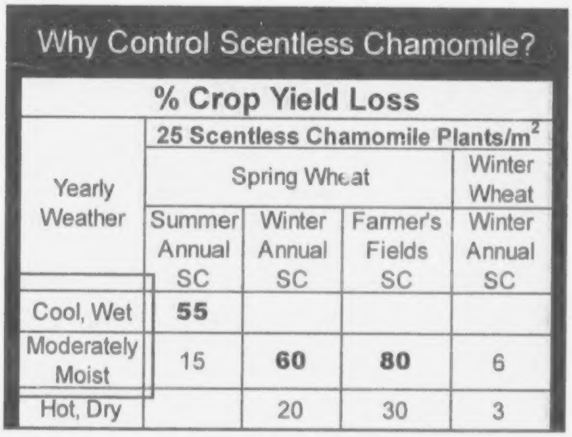
Everyone should look for noxious weeds

Pesticide Applicator License
- Industrial Vegetation: $160 + $40 (Books)
- Renew every 5 yrs: $40 + $40 (Books)



Don't Confuse the Different Types of Weed Control

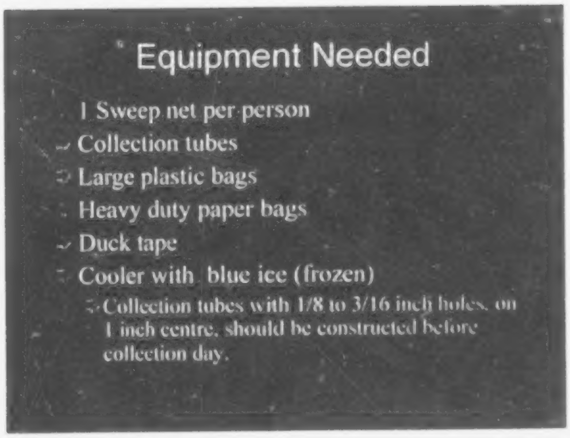
1. Crop Protection
2. Industrial Vegetation Management
   - Good visibility on right-of-ways
   - Keep road shoulders vegetation free
     - Safe emergency stops
     - Prevent snow accumulation
3. Noxious Weed Control
   - Managing weed populations



Why Control Scentless Chamomile?

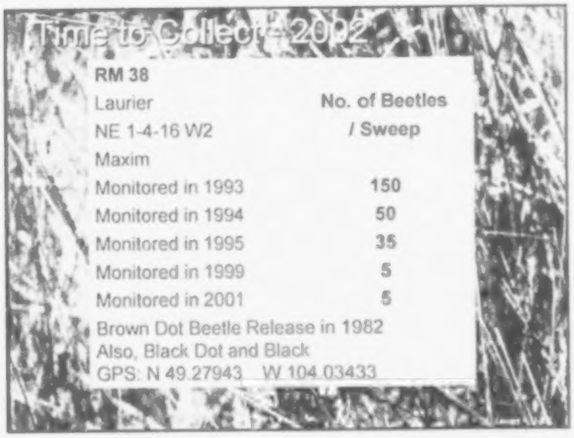
% Crop Yield Loss

Yearly Weather	25 Scentless Chamomile Plants/m^2			
	Spring Wheat			Winter Wheat
	Summer Annual SC	Winter Annual SC	Farmer's Fields SC	Winter Annual SC
Cool, Wet	**55**			
Moderately Moist	15	**60**	**80**	6
Hot, Dry		20	30	3



Equipment Needed

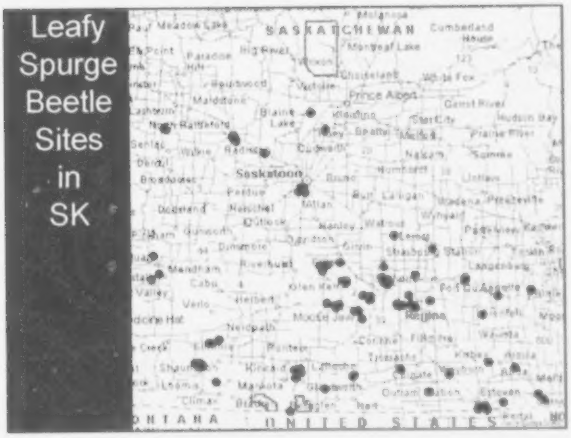
- 1 Sweep net per person
- Collection tubes
- Large plastic bags
- Heavy duty paper bags
- Duck tape
- Cooler with blue ice (frozen)
  - Collection tubes with 1/8 to 3/16 inch holes, on 1 inch centre, should be constructed before collection day.



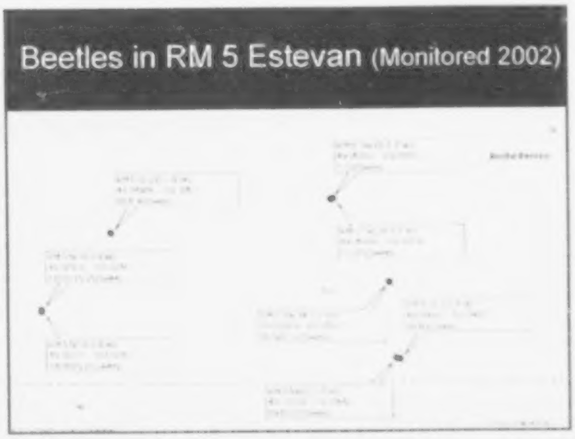
Time to Collect - 2002

RM 38	
Laurier	No. of Beetles / Sweep
NE 1-4-16 W2	
Maxim	
Monitored in 1993	150
Monitored in 1994	50
Monitored in 1995	35
Monitored in 1999	5
Monitored in 2001	5

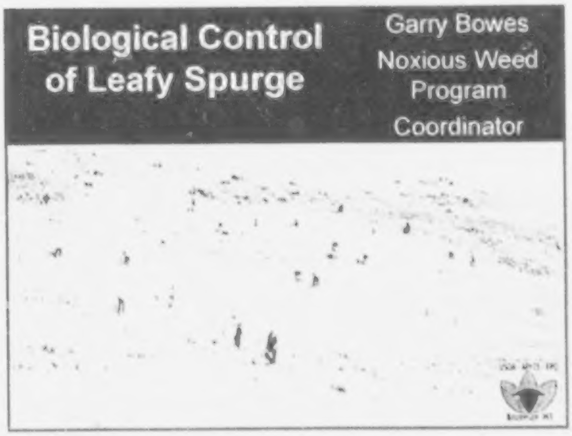
Brown Dot Beetle Release in 1982
Also, Black Dot and Black
GPS: N 49.27943 W 104.03433



Leafy Spurge Beetle Sites in SK

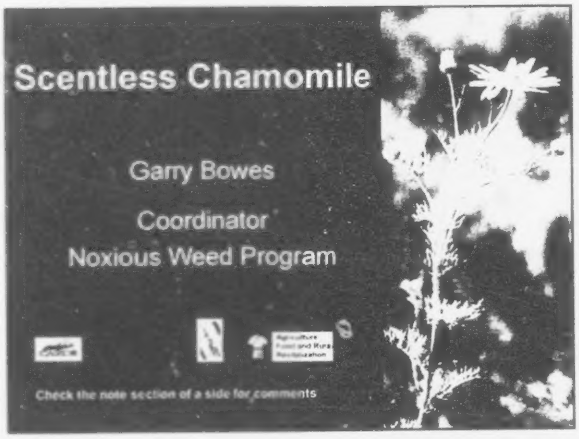


Beetles in RM 5 Estevan (Monitored 2002)



Biological Control of Leafy Spurge

Garry Bowes
Noxious Weed Program Coordinator

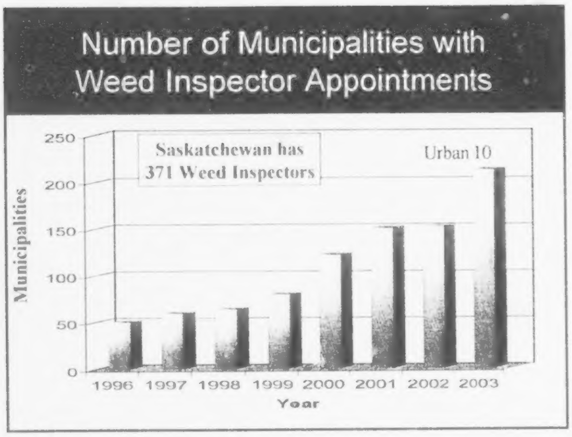


Scentless Chamomile

Garry Bowes

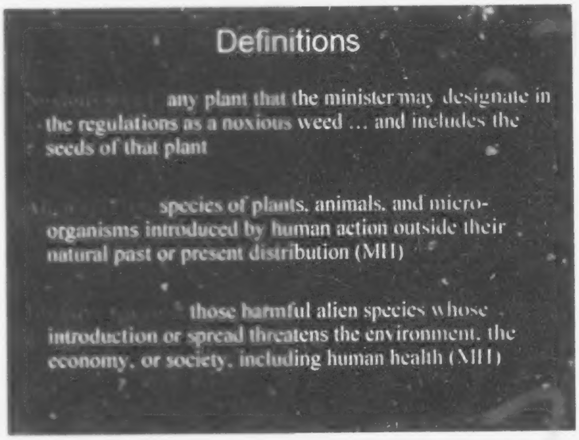
Coordinator
Noxious Weed Program

Check the note section of a side for comments



Number of Municipalities with Weed Inspector Appointments

Saskatchewan has
371 Weed Inspectors

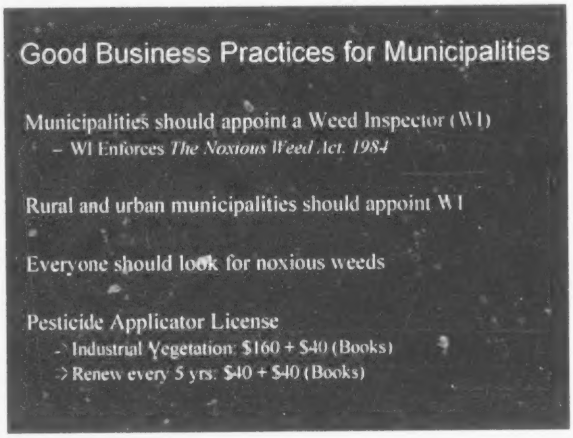


Definitions

[illegible] any plant that the minister may designate in the regulations as a noxious weed … and includes the seeds of that plant

[illegible] species of plants, animals, and micro-organisms introduced by human action outside their natural past or present distribution (MH)

[illegible] those harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health (MH)



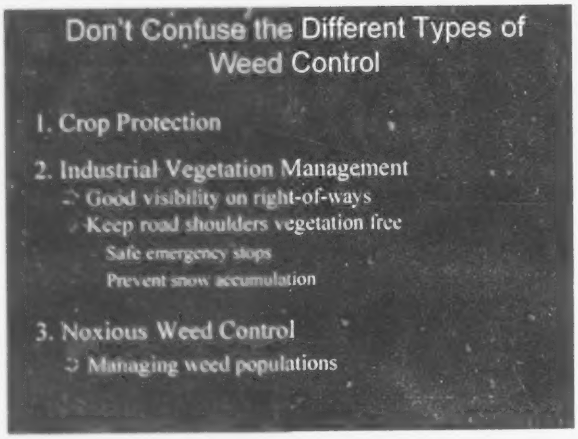
Good Business Practices for Municipalities

Municipalities should appoint a Weed Inspector (WI)
  – WI Enforces *The Noxious Weed Act, 1984*

Rural and urban municipalities should appoint WI

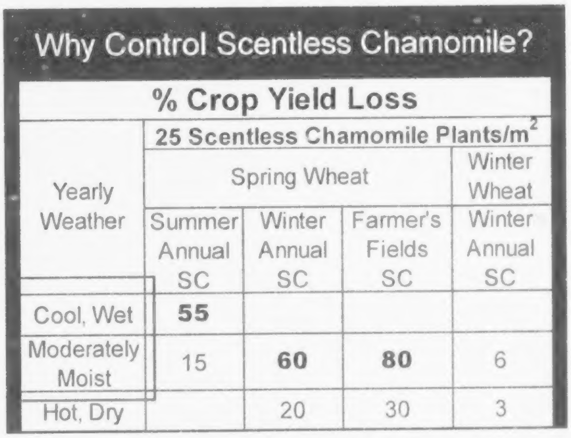
Everyone should look for noxious weeds

Pesticide Applicator License
  ⇢ Industrial Vegetation: $160 + $40 (Books)
  ⇢ Renew every 5 yrs: $40 + $40 (Books)



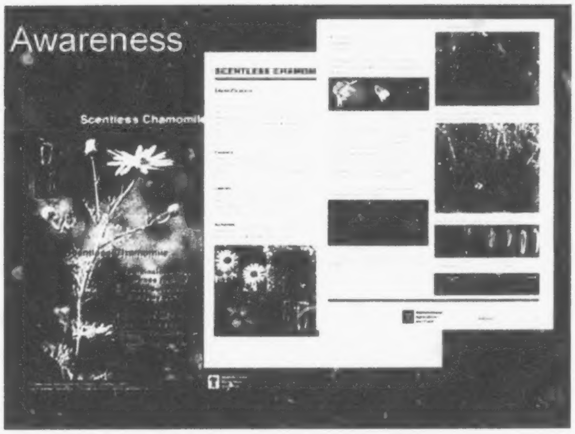
Don't Confuse the Different Types of Weed Control

1. Crop Protection
2. Industrial Vegetation Management
   - ⇢ Good visibility on right-of-ways
   - ⇢ Keep road shoulders vegetation free
     - Safe emergency stops
     - Prevent snow accumulation
3. Noxious Weed Control
   - ⇢ Managing weed populations

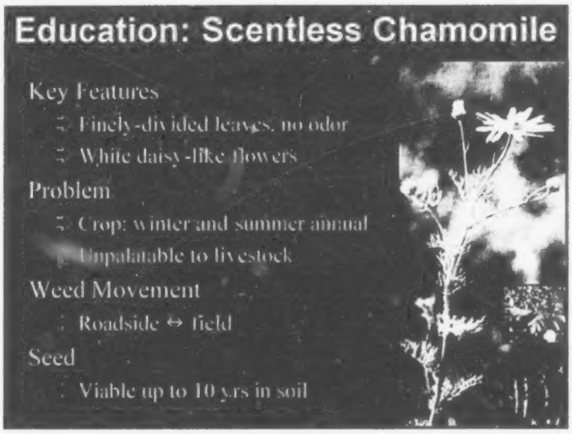


Why Control Scentless Chamomile?

% Crop Yield Loss				
	25 Scentless Chamomile Plants/m^2			
Yearly Weather	Spring Wheat			Winter Wheat
	Summer Annual SC	Winter Annual SC	Farmer's Fields SC	Winter Annual SC
Cool, Wet	**55**			
Moderately Moist	15	**60**	**80**	6
Hot, Dry		20	30	3



Awareness



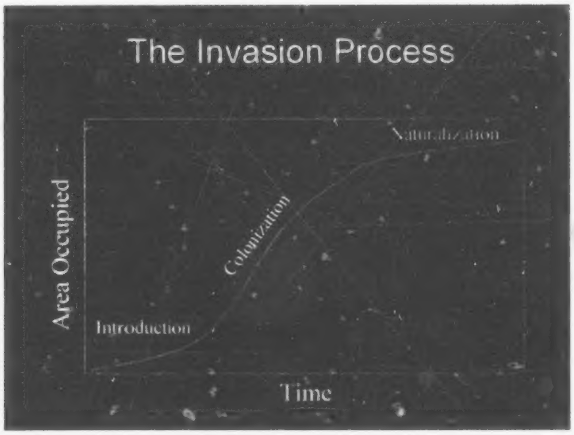
Education: Scentless Chamomile

Key Features
- Finely-divided leaves, no odor
- White daisy-like flowers

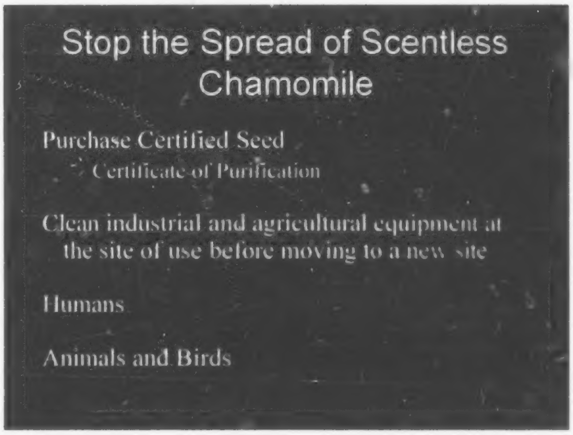
Problem
- Crop: winter and summer annual
- Unpalatable to livestock

Weed Movement
- Roadside ↔ field

Seed
- Viable up to 10 yrs in soil



The Invasion Process



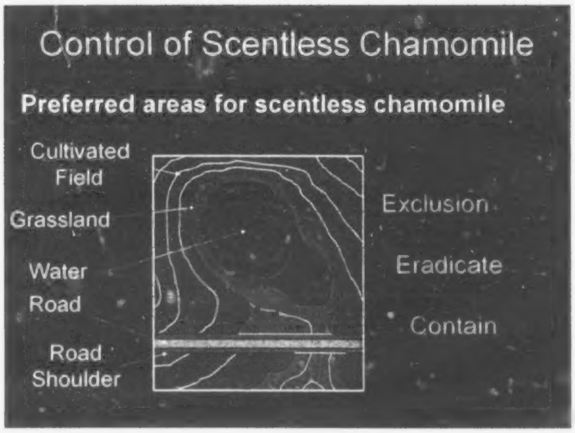
Stop the Spread of Scentless Chamomile

Purchase Certified Seed
- Certificate of Purification

Clean industrial and agricultural equipment at the site of use before moving to a new site

Humans

Animals and Birds



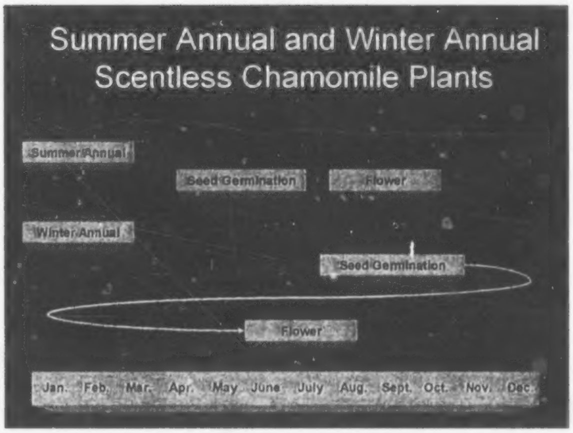
Control of Scentless Chamomile

Preferred areas for scentless chamomile

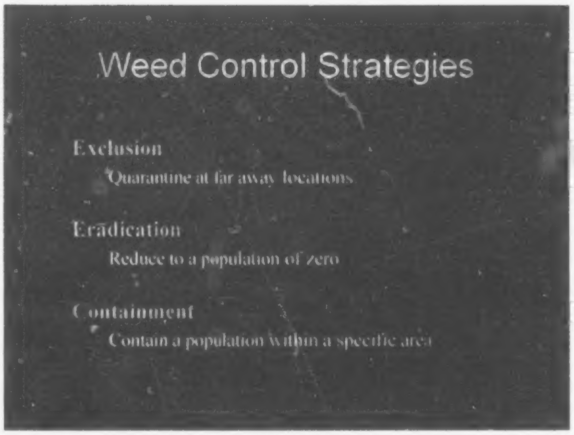
Exclusion

Eradicate

Contain



Summer Annual and Winter Annual Scentless Chamomile Plants



Weed Control Strategies

Exclusion
- Quarantine at far away locations

Eradication
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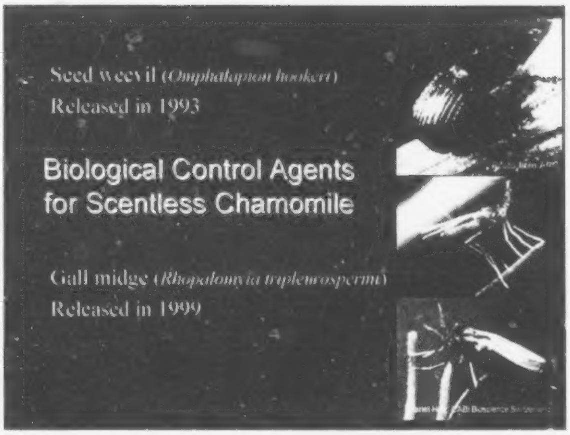
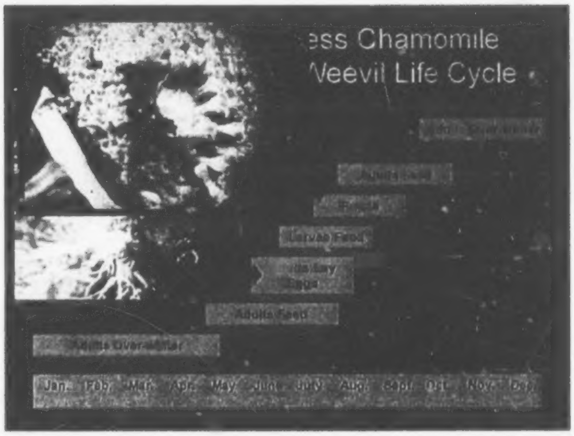
Containment
- Contain a population within a specific area



Seed weevil (*Omphalapion hookeri*)
Released in 1993

Biological Control Agents for Scentless Chamomile

Gall midge (*Rhopalomyia tripleurospermi*)
Released in 1999



ess Chamomile Veevil Life Cycle

Adults Feed

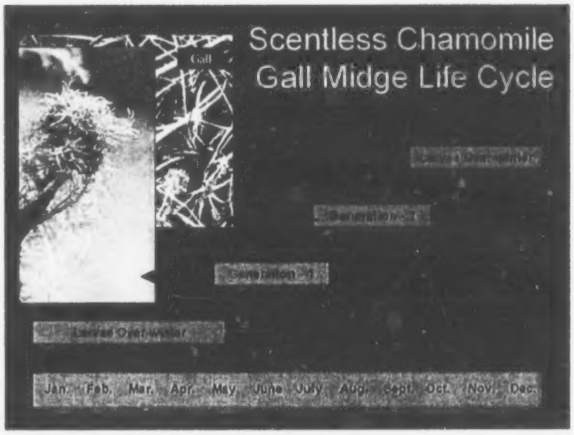
Larvae Feed

Adults lay Eggs

Adults Feed

Adults Over-winter

Scentless Chamomile Seed Weevil *Omphalapion hookeri*

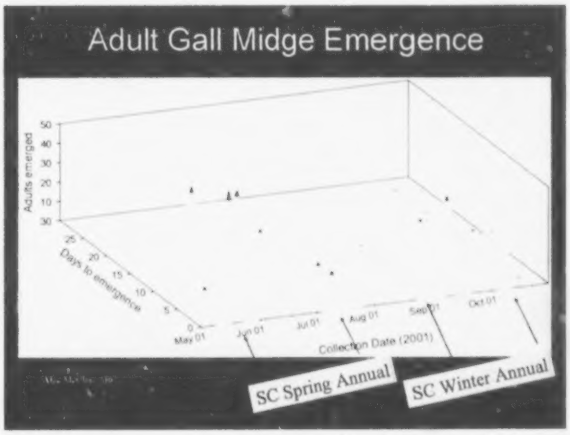


Scentless Chamomile Gall Midge Life Cycle

Generation 2

Generation 1

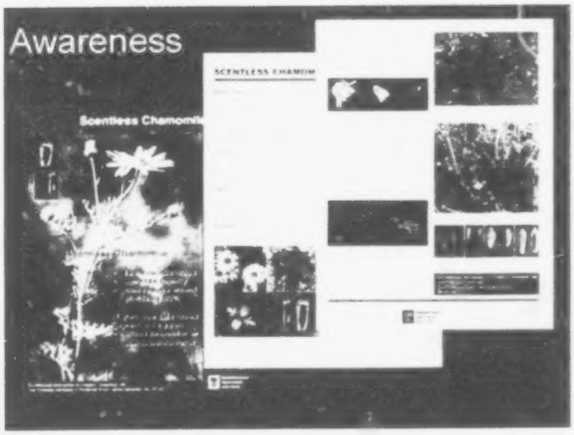
Larvae Over-winter



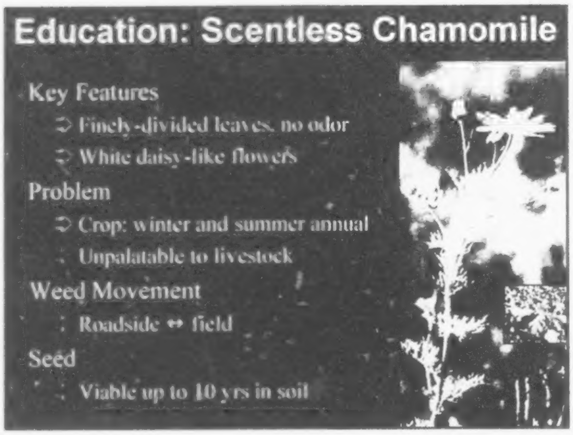
Adult Gall Midge Emergence

SC Spring Annual

SC Winter Annual



Awareness



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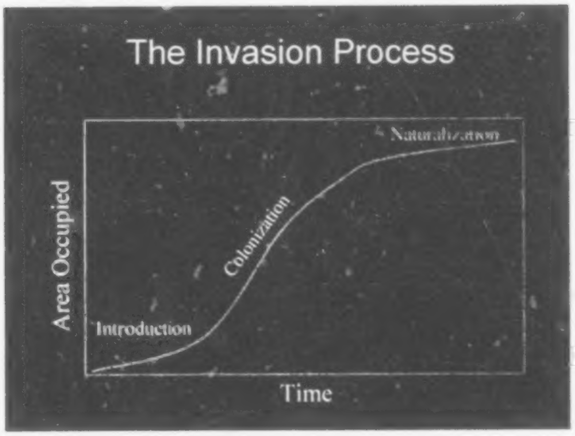

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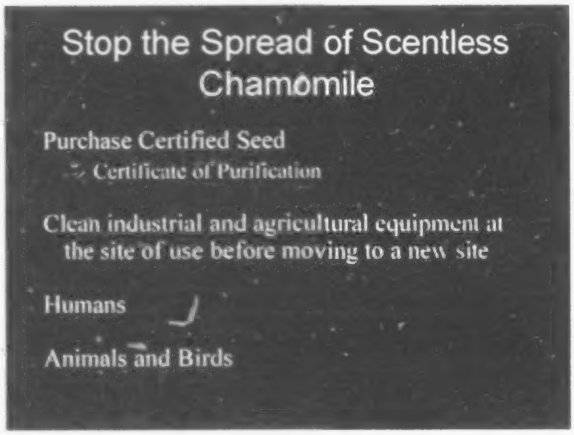

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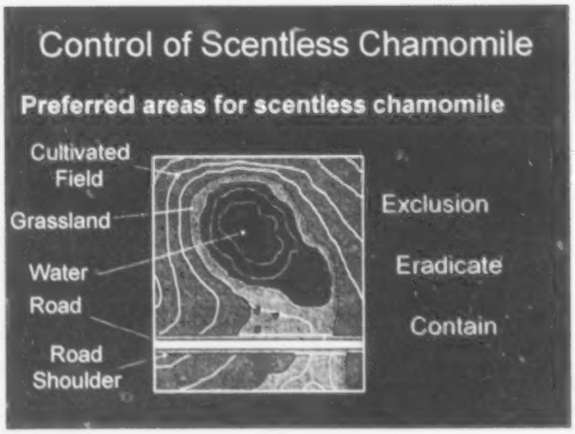

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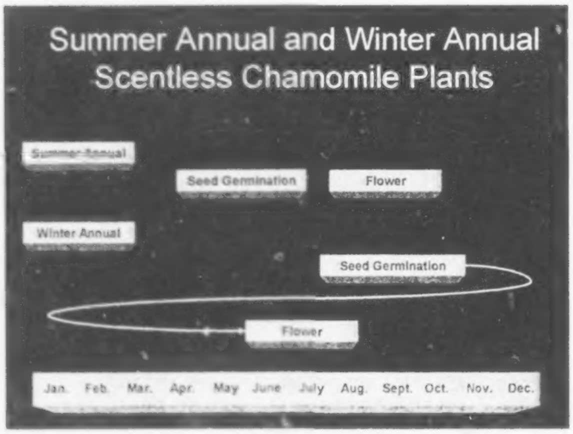
Contain



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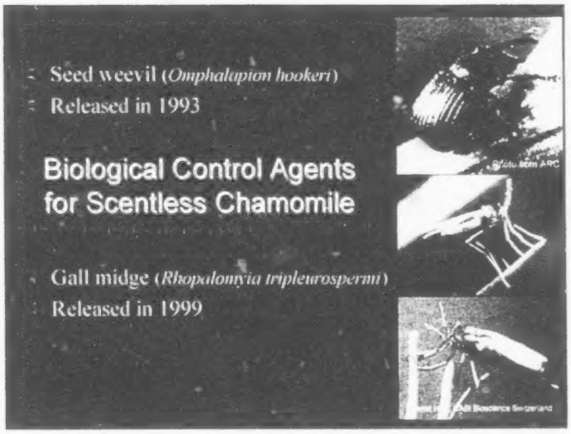

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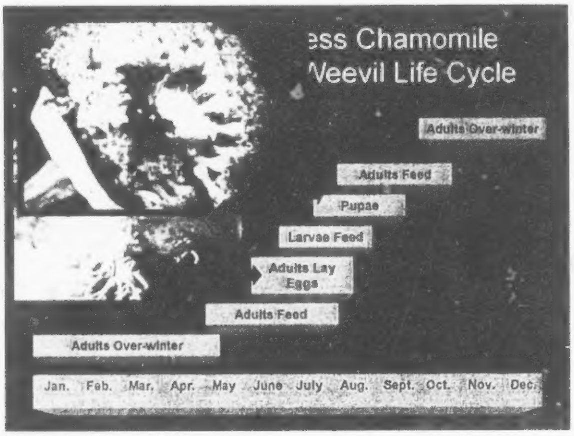
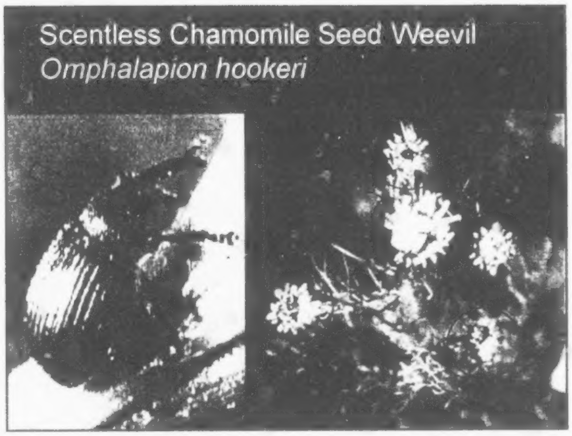
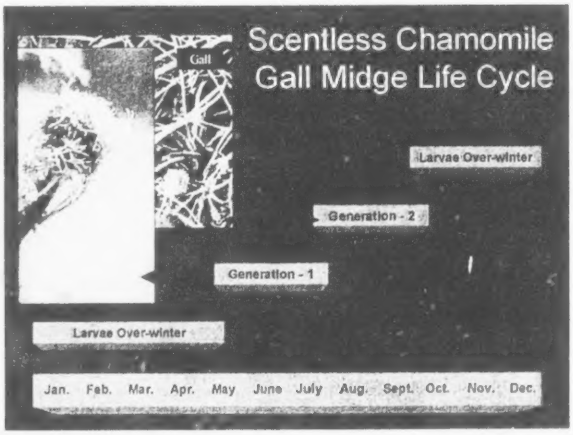


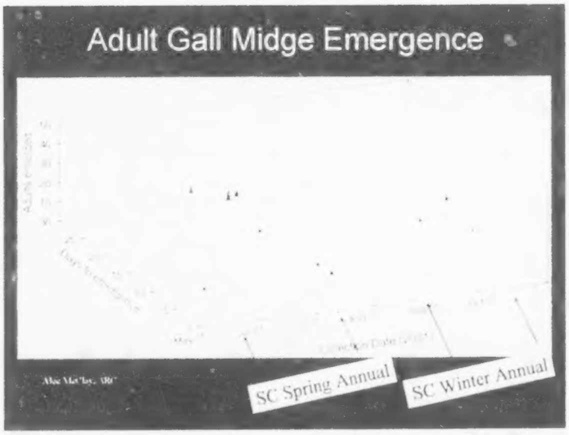
ess Chamomile Weevil Life Cycle



Scentless Chamomile Seed Weevil *Omphalapion hookeri*

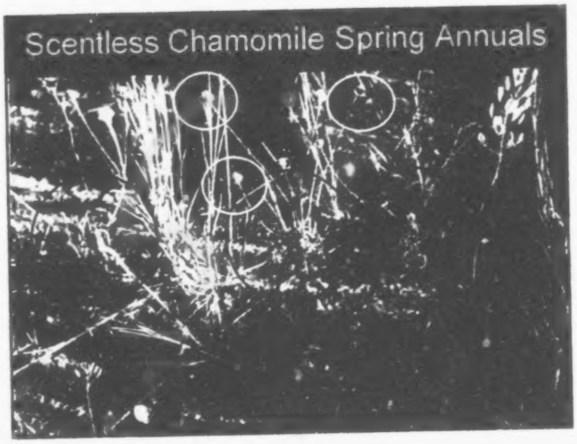


Scentless Chamomile Gall Midge Life Cycle

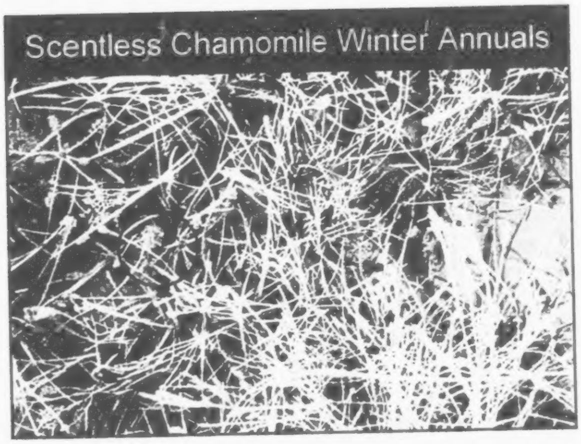


Adult Gall Midge Emergence

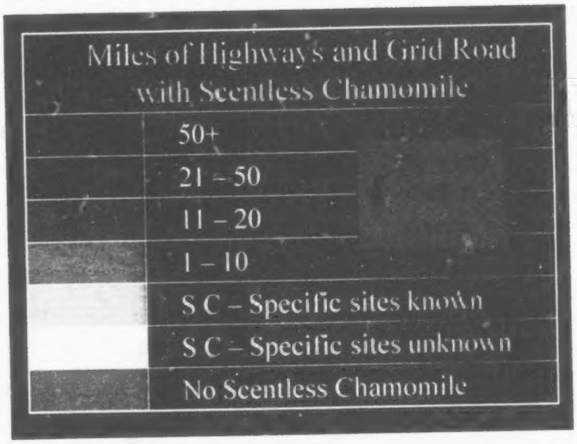
Alec McClay, ARC



Scentless Chamomile Spring Annuals

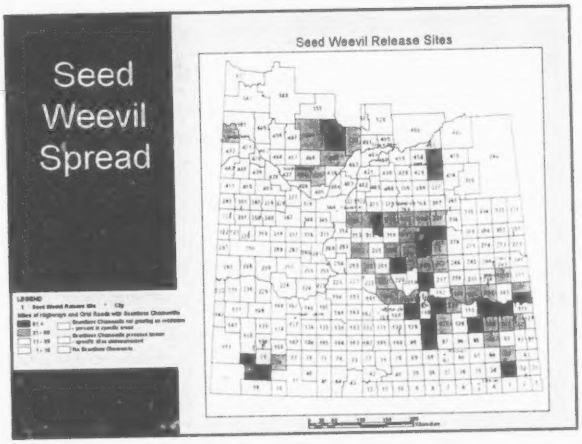


Scentless Chamomile Winter Annuals



Miles of Highways and Grid Road with Scentless Chamomile

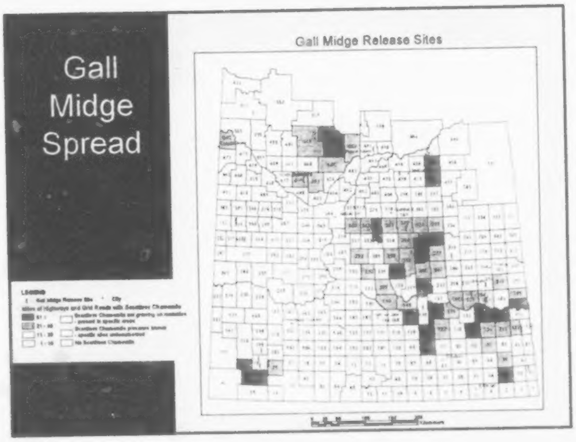
■	50+
■	21 – 50
■	11 – 20
▨	1 – 10
□	S C – Specific sites known
□	S C – Specific sites unknown
▨	No Scentless Chamomile



Seed Weevil Spread

Seed Weevil Release Sites

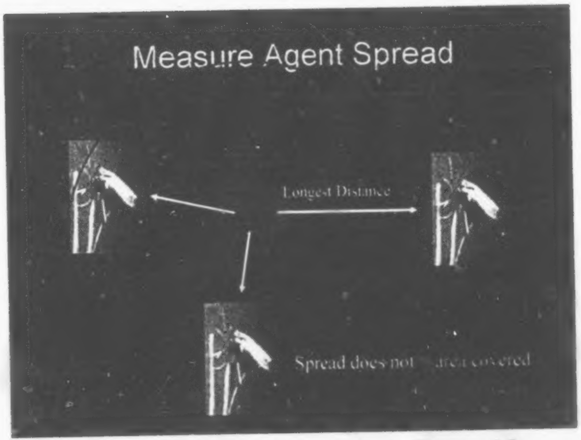
LEGEND



Gall Midge Spread

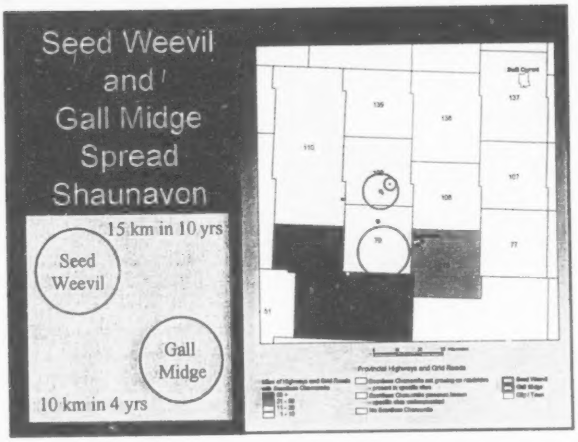
Gall Midge Release Sites

LEGEND

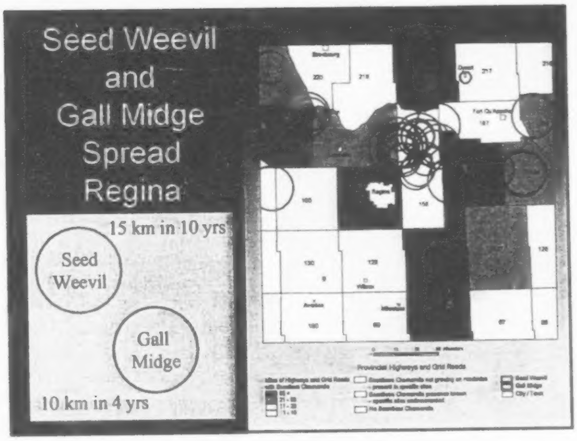


Measure Agent Spread

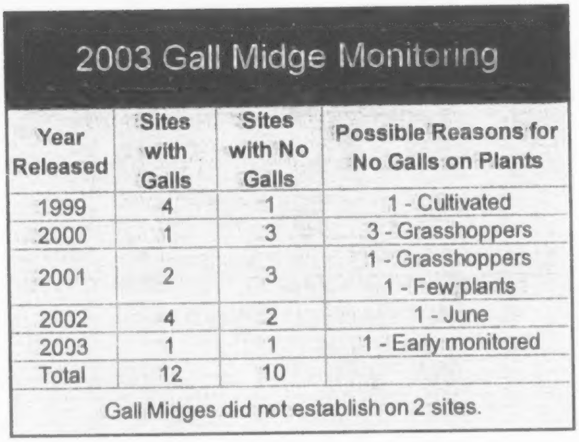
Spread does not [illegible] area covered



Seed Weevil and Gall Midge Spread Shaunavon



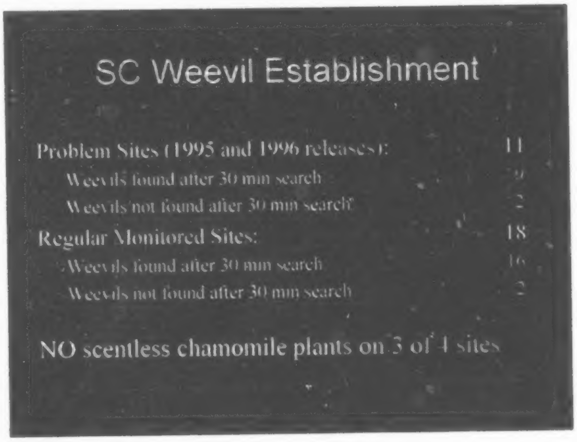
Seed Weevil and Gall Midge Spread Regina



2003 Gall Midge Monitoring

Year Released	Sites with Galls	Sites with No Galls	Possible Reasons for No Galls on Plants
1999	4	1	1 - Cultivated
2000	1	3	3 - Grasshoppers
2001	2	3	1 - Grasshoppers 1 - Few plants
2002	4	2	1 - June
2003	1	1	1 - Early monitored
Total	12	10	

Gall Midges did not establish on 2 sites.

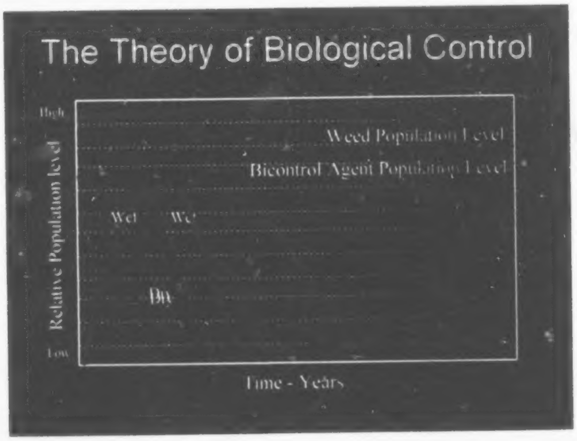


SC Weevil Establishment

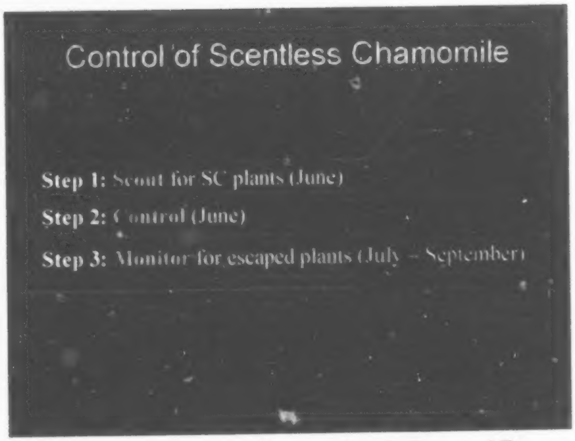
Problem Sites (1995 and 1996 releases): 11
- Weevils found after 30 min search 9
- Weevils not found after 30 min search 2

Regular Monitored Sites: 18
- Weevils found after 30 min search 16
- Weevils not found after 30 min search 2

NO scentless chamomile plants on 3 of 4 sites



The Theory of Biological Control

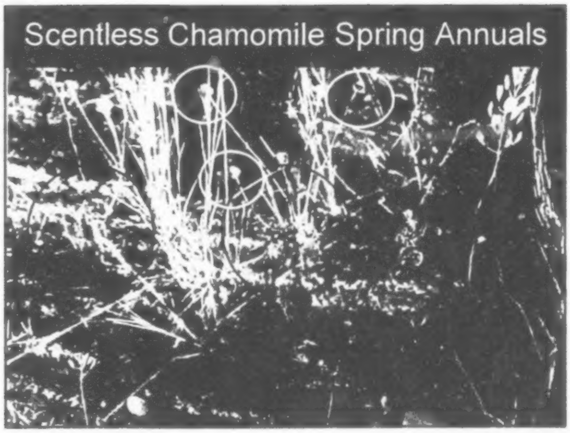


Control of Scentless Chamomile

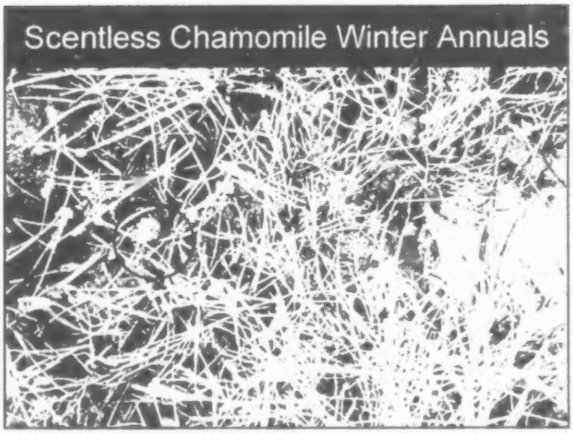
Step 1: Scout for SC plants (June)

Step 2: Control (June)

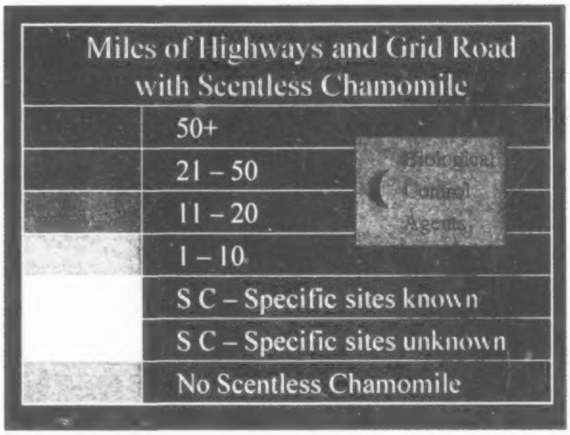
Step 3: Monitor for escaped plants (July – September)



Scentless Chamomile Spring Annuals



Scentless Chamomile Winter Annuals



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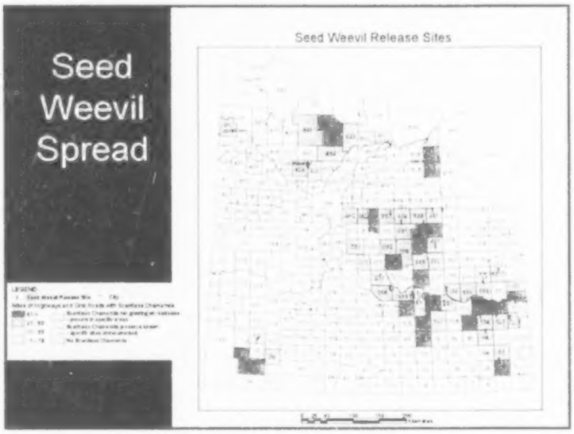
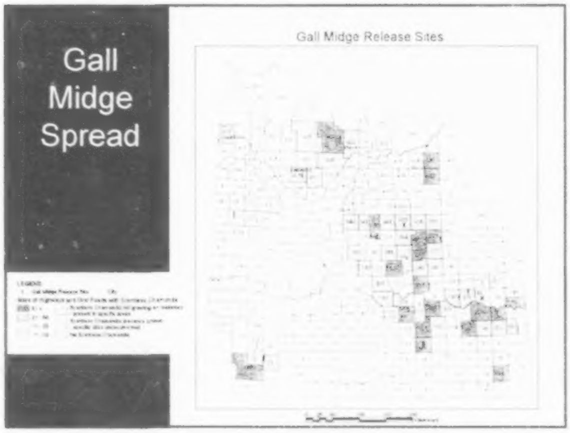
Biological Control Agents



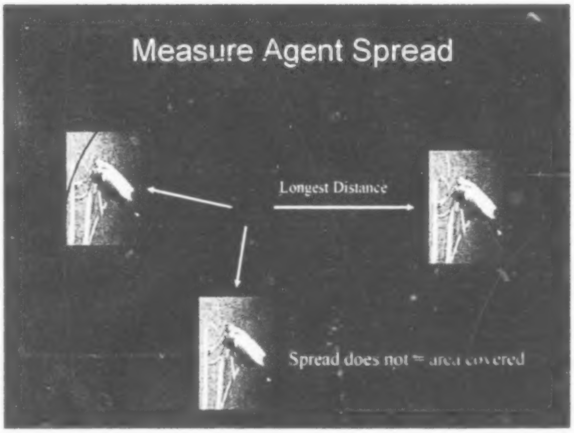
Seed Weevil Spread

Seed Weevil Release Sites



Gall Midge Spread

Gall Midge Release Sites



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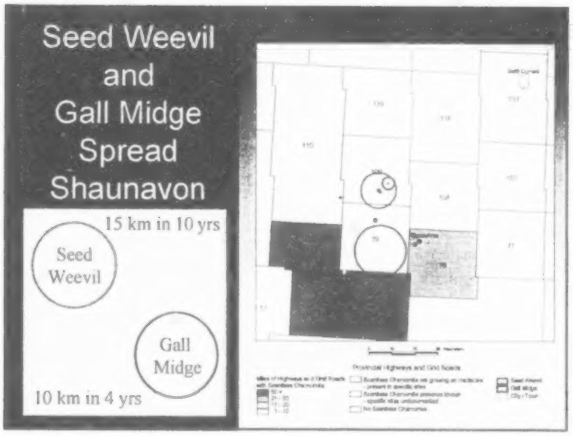


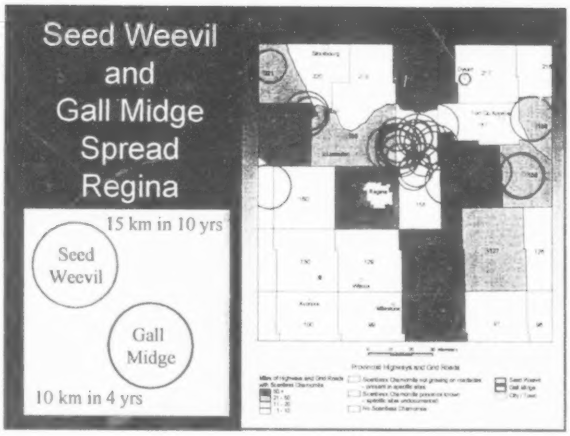
Seed Weevil and Gall Midge Spread Shaunavon

15 km in 10 yrs

Seed Weevil

Gall Midge

10 km in 4 yrs



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Seed Weevil

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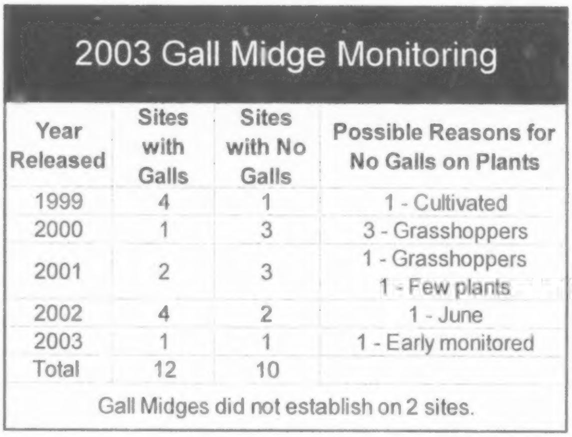

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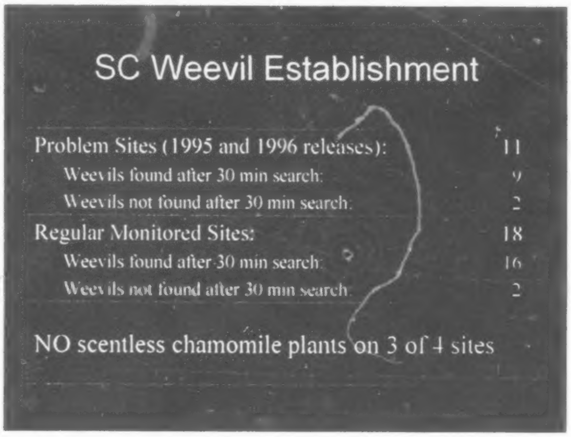

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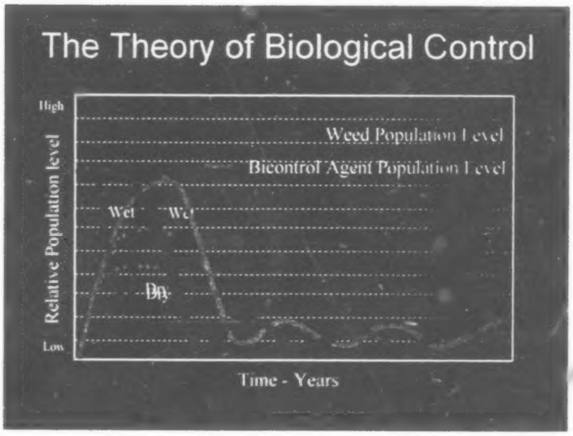
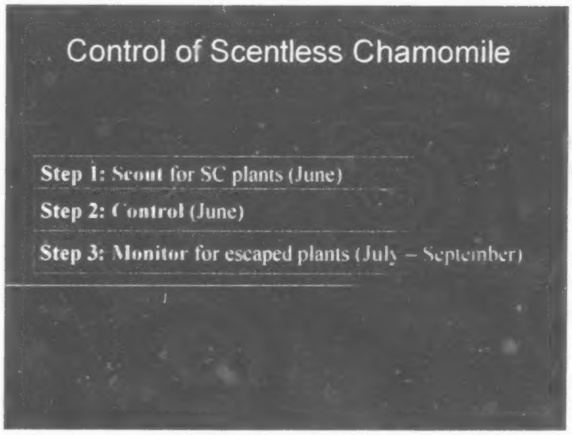
Weevils found after 30 min search:	9
Weevils not found after 30 min search:	2
Regular Monitored Sites:	18
Weevils found after 30 min search:	16
Weevils not found after 30 min search:	2

NO scentless chamomile plants on 3 of 4 sites



The Theory of Biological Control

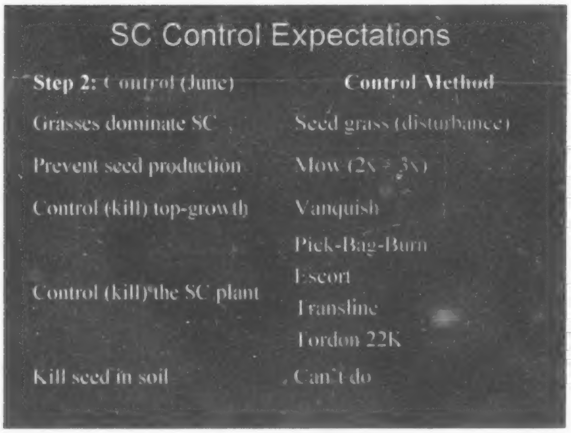


Control of Scentless Chamomile

Step 1: **Scout** for SC plants (June)

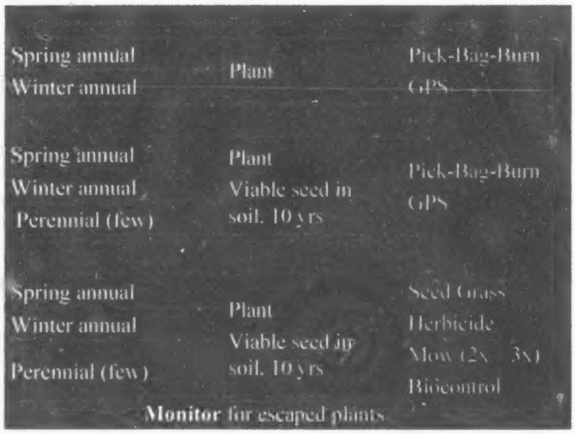
Step 2: **Control** (June)

Step 3: **Monitor** for escaped plants (July – September)



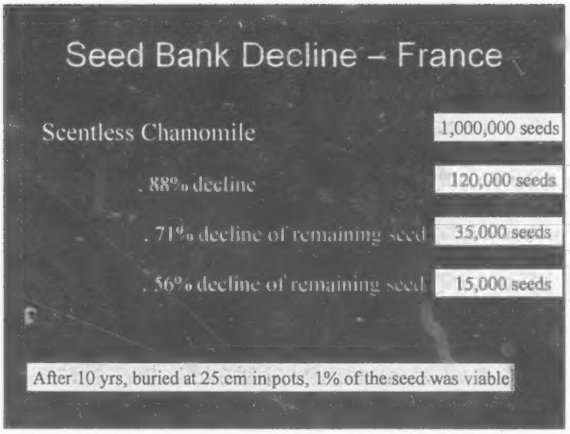
SC Control Expectations

Step 2: Control (June)	**Control Method**
Grasses dominate SC	Seed grass (disturbance)
Prevent seed production	Mow (2x – 3x)
Control (kill) top-growth	Vanquish
Control (kill) the SC plant	Pick-Bag-Burn Escort Transline Tordon 22K
Kill seed in soil	Can't do



Spring annual Winter annual	Plant	Pick-Bag-Burn GPS
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil. 10 yrs	Pick-Bag-Burn GPS
Spring annual Winter annual Perennial (few)	Plant Viable seed in soil. 10 yrs	Seed Grass Herbicide Mow (2x – 3x) Biocontrol

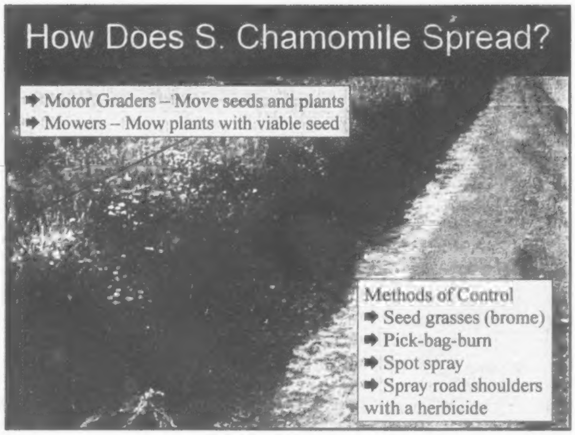
Monitor for escaped plants



Seed Bank Decline – France

Scentless Chamomile	1,000,000 seeds
. 88% decline	120,000 seeds
. 71% decline of remaining seed	35,000 seeds
. 56% decline of remaining seed	15,000 seeds

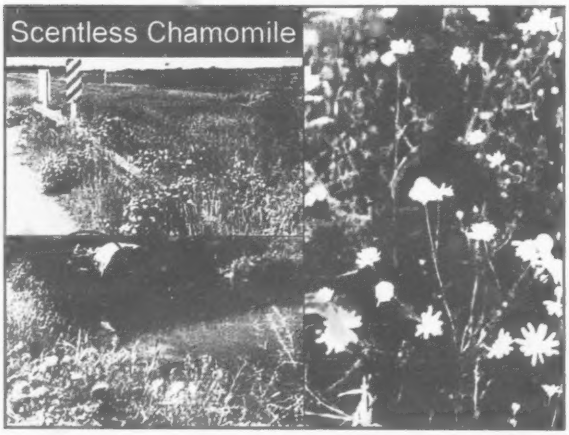
After 10 yrs, buried at 25 cm in pots, 1% of the seed was viable



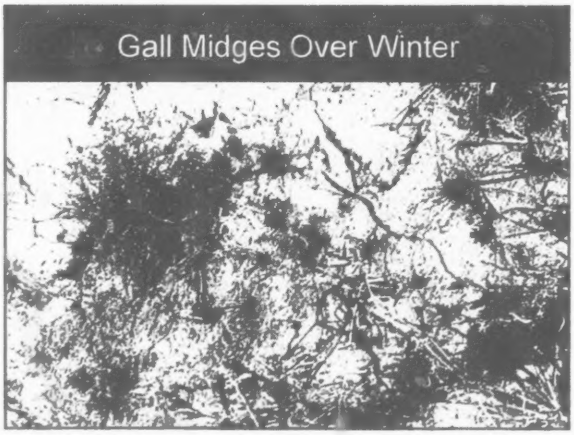
How Does S. Chamomile Spread?

- ➡ Motor Graders – Move seeds and plants
- ➡ Mowers – Mow plants with viable seed

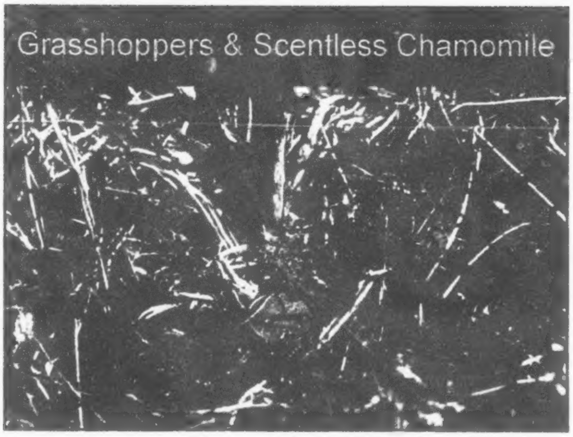
Methods of Control
- ➡ Seed grasses (brome)
- ➡ Pick-bag-burn
- ➡ Spot spray
- ➡ Spray road shoulders with a herbicide



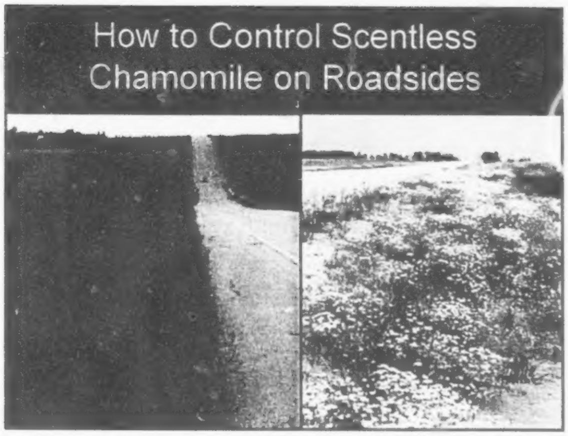
Scentless Chamomile



Gall Midges Over Winter

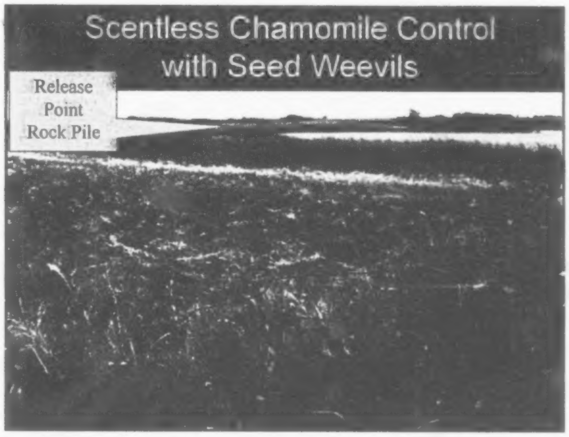


Grasshoppers & Scentless Chamomile



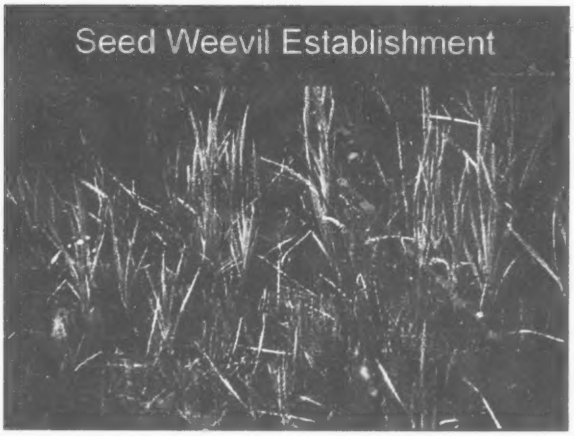
How to Control Scentless Chamomile on Roadsides

Is Competition Perfect?

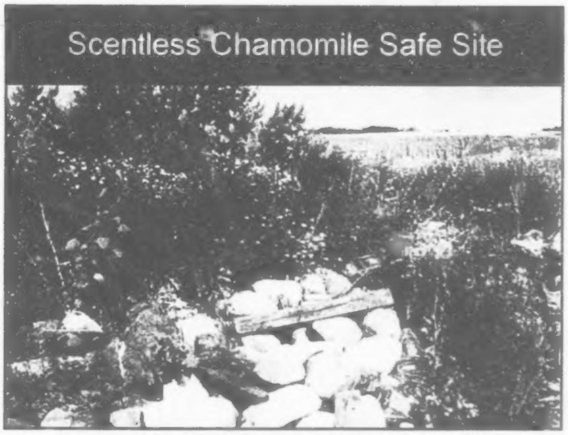


Scentless Chamomile Control with Seed Weevils

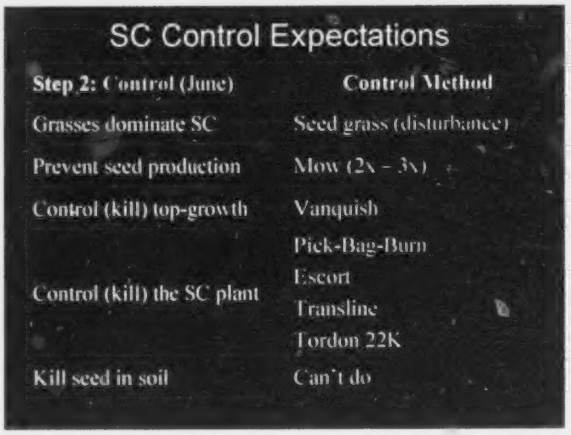
Release Point Rock Pile



Seed Weevil Establishment



Scentless Chamomile Safe Site



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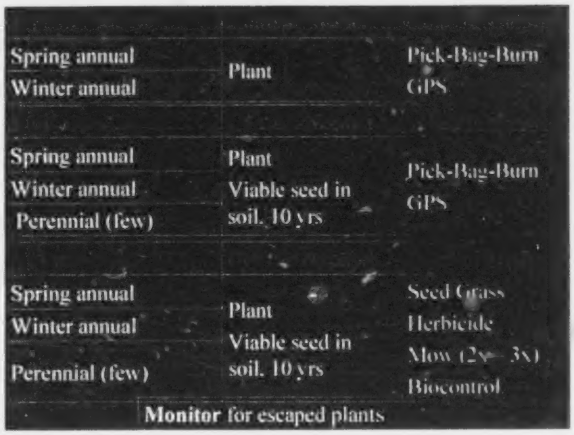

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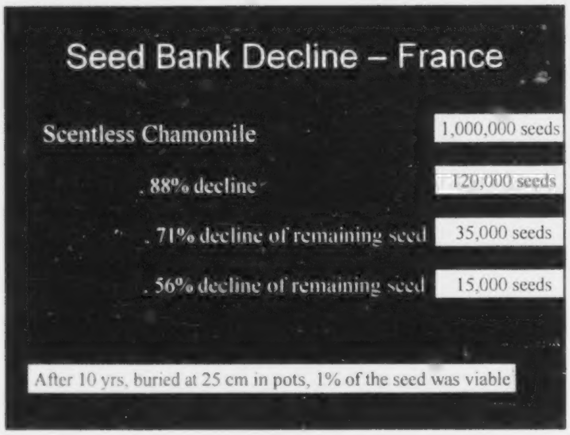

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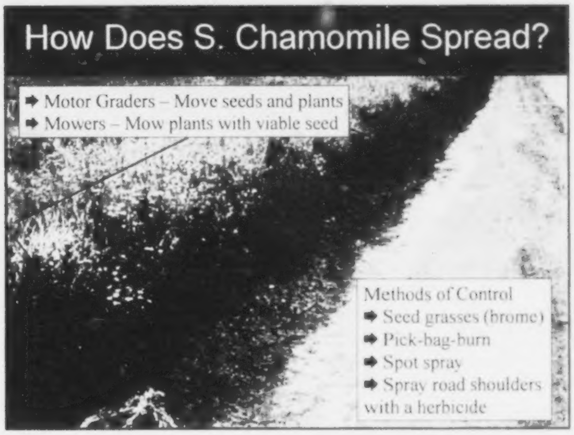

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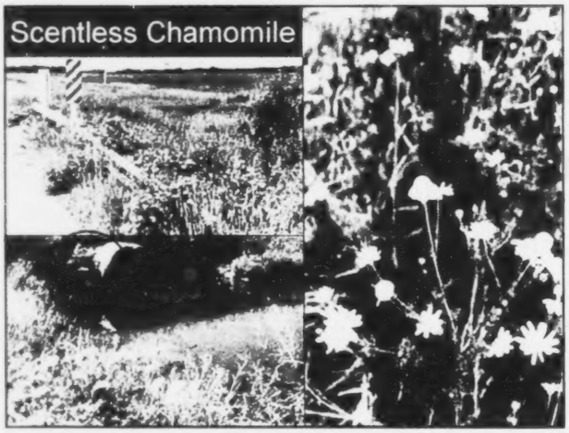
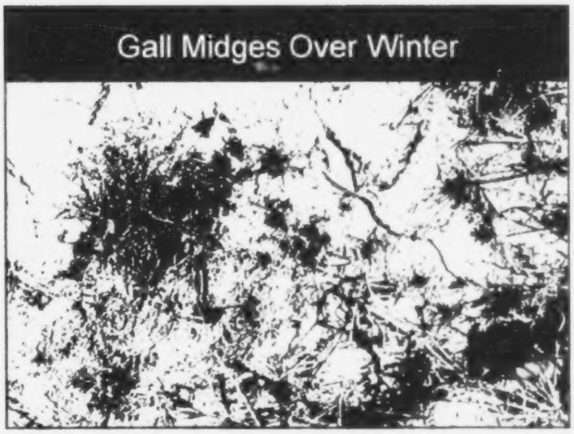


Scentless Chamomile



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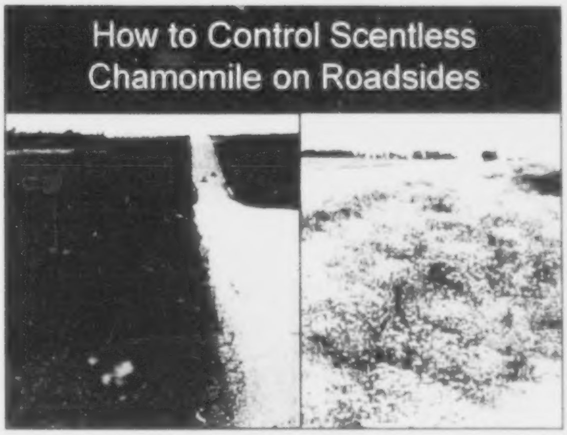

How to Control Scentless Chamomile on Roadsides

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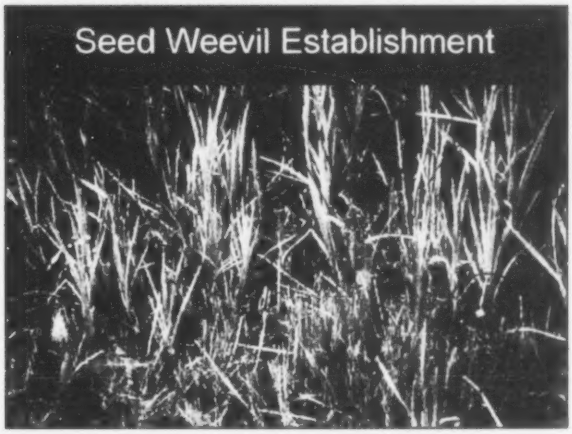
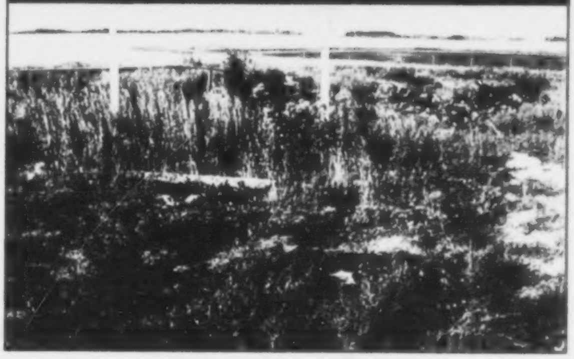
Scentless Chamomile Control with Seed Weevils



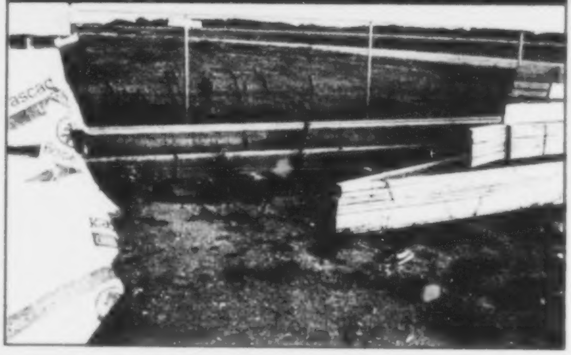
Seed Weevil Establishment

Scentless Chamomile Safe Site

Scentless Chamomile Safe Site



Scentless Chamomile Safe Site



Scentless Chamomile Safe Site

Scentless Chamomile Dangerous Site

Scentless Chamomile Safe Site

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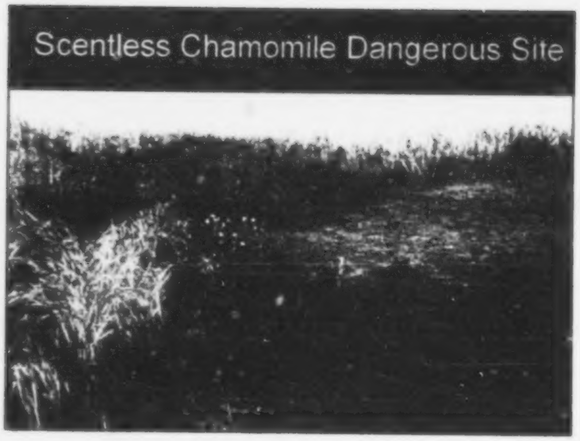
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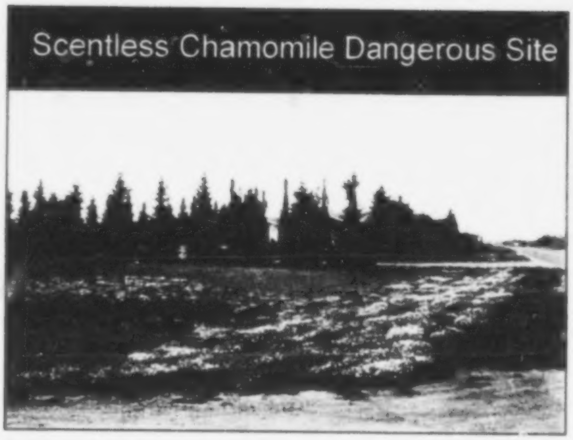
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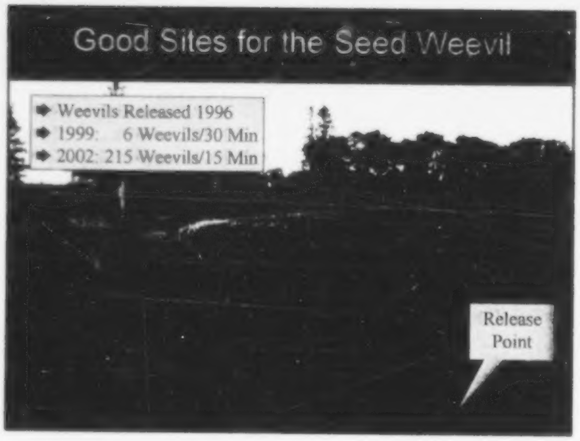
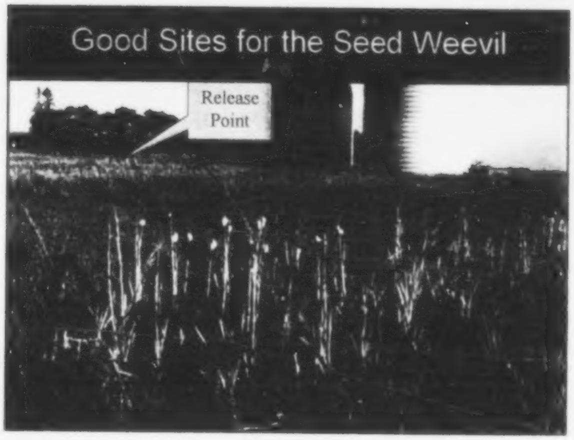

Good Sites for the Seed Weevil

- Weevils Released 1996
- 1999: 6 Weevils/30 Min
- 2002: 215 Weevils/15 Min

Release Point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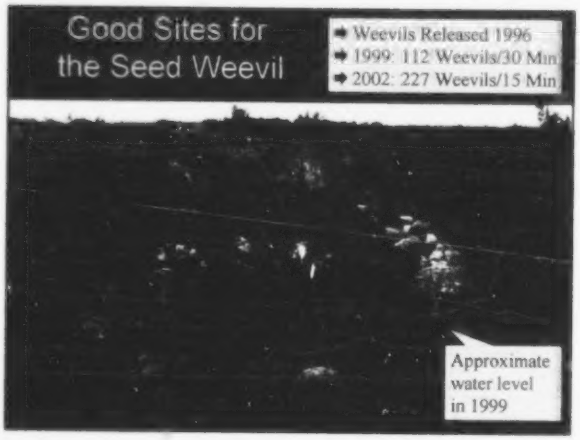
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Approximate water level in 1999

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Scentless Chamomile Safe Site

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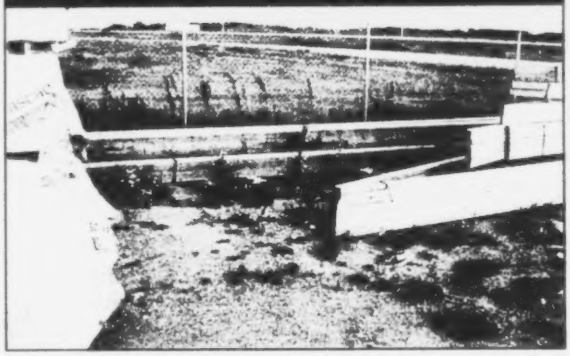

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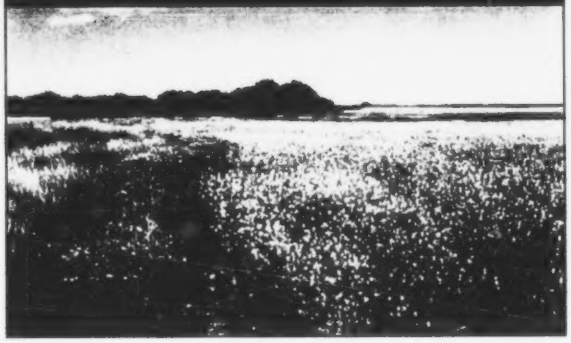

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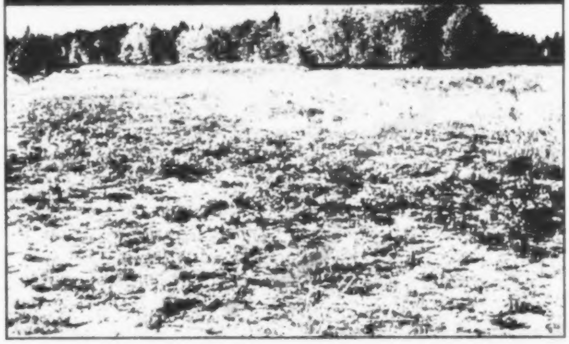

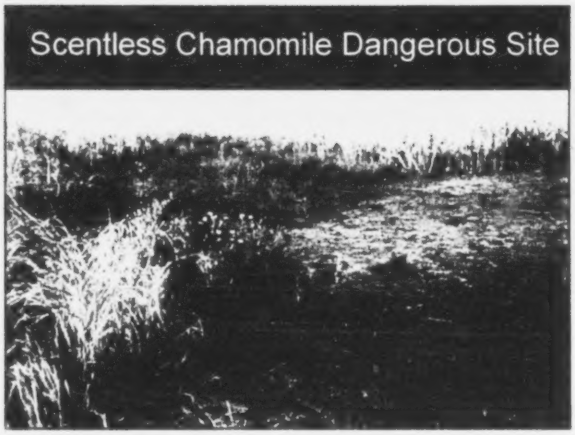

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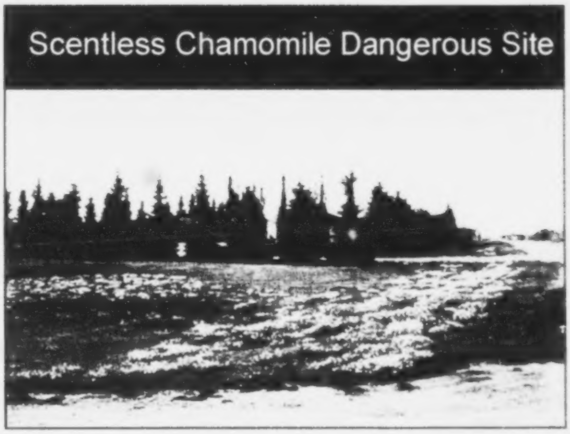

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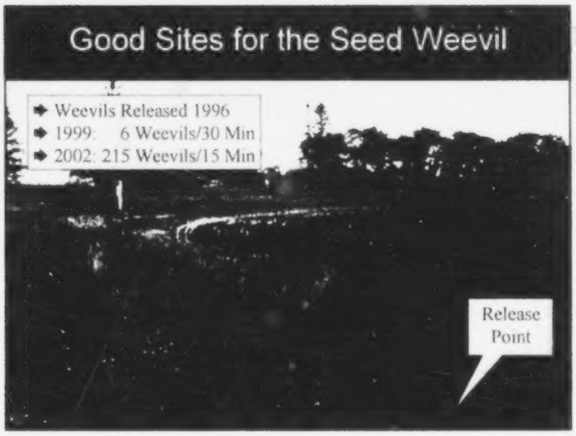

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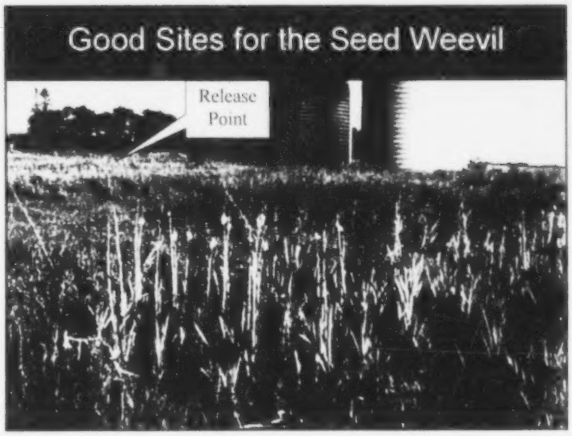

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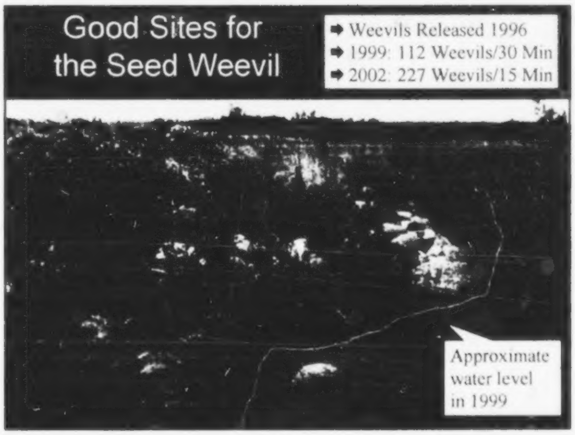

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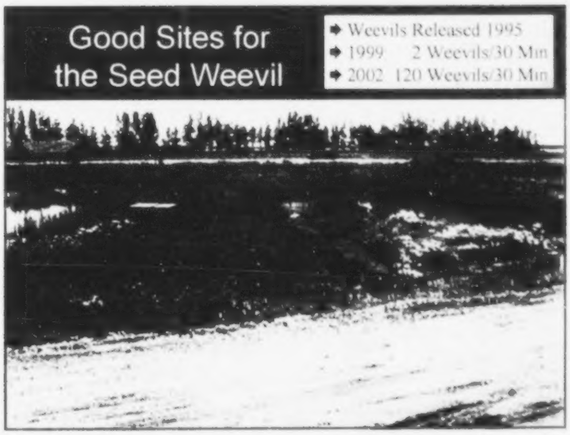

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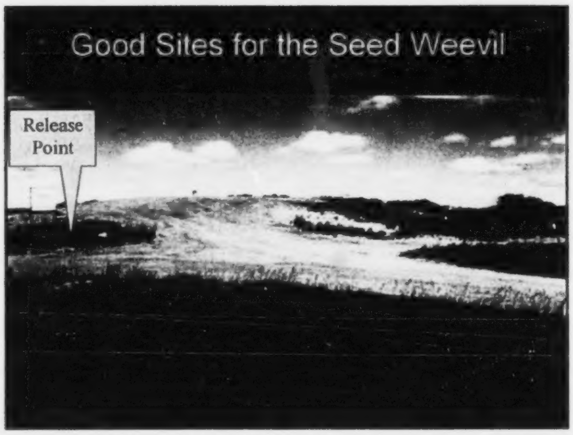


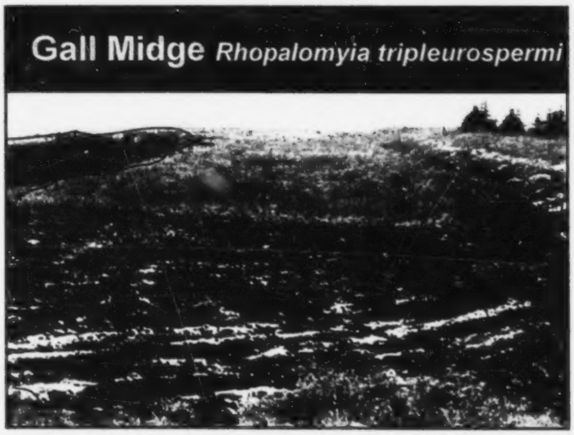
Good Sites for the Seed Weevil

Release Point

Scentless Chamomile Gall Midge

Gall Midge *Rhopalomyia tripleurospermi*

Gall Midge ***Rhopalomyia tripleurospermi***



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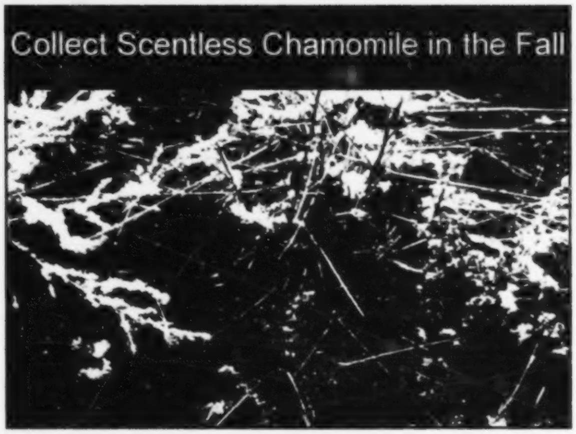
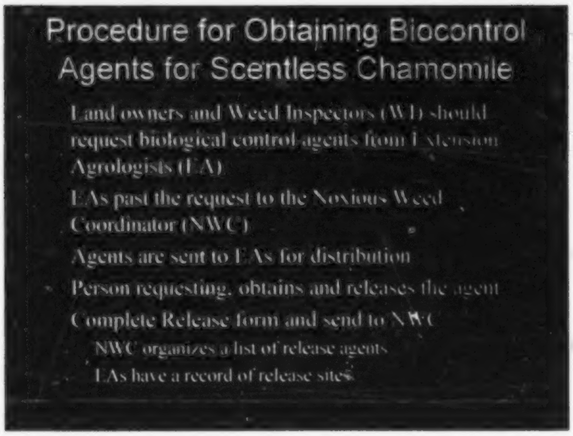


Collect Scentless Chamomile in the Fall



Procedure for Obtaining Biocontrol Agents for Scentless Chamomile

- Land owners and Weed Inspectors (WI) should request biological control agents from Extension Agrologists (EA)
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- Agents are sent to EAs for distribution
- Person requesting, obtains and releases the agent
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  - NWC organizes a list of release agents
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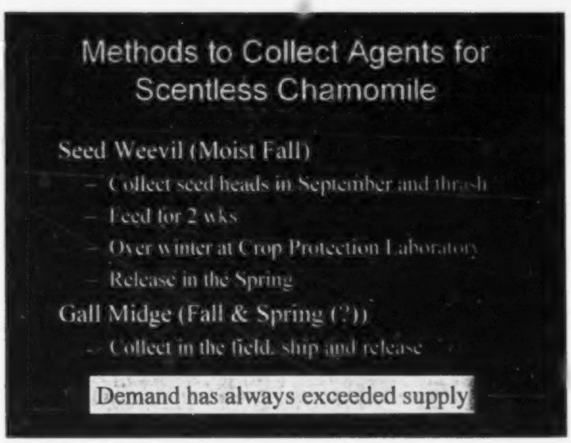

Methods to Collect Agents for Scentless Chamomile

- Seed Weevil (Moist Fall)
  - Collect seed heads in September and thrash
  - Feed for 2 wks
  - Over winter at Crop Protection Laboratory
  - Release in the Spring
- Gall Midge (Fall & Spring (?))
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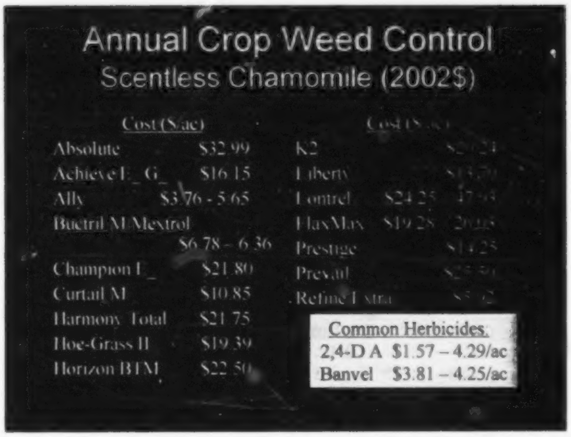
Demand has always exceeded supply

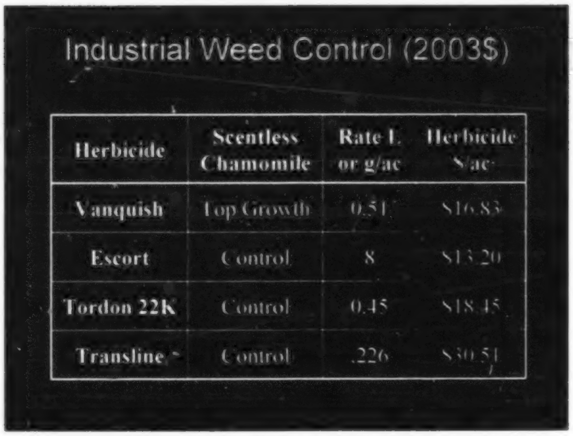
Seed Weevil Collection



Annual Crop Weed Control
Scentless Chamomile (2002$)

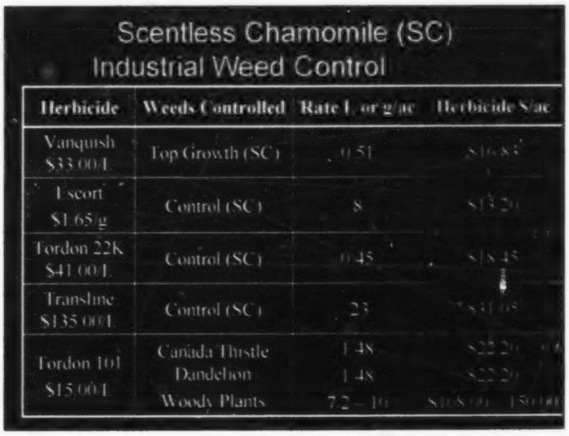
	Cost ($/ac)		Cost ($/ac)
Absolute	$32.99	K2	[illegible]
Achieve L_G_	$16.15	Liberty	[illegible]
Ally	$3.76 - 5.65	Lontrel	$24.25 – [illegible]
Buctril M/Mextrol	$6.78 – 6.36	FlaxMax	$19.28 – [illegible]
Champion E_	$21.80	Prestige	$14.28
Curtail M	$10.85	Prevail	[illegible]
Harmony Total	$21.75	Refine Extra	[illegible]
Hoe-Grass II	$19.39		
Horizon BTM	$22.50		

Common Herbicides:
2,4-D A $1.57 – 4.29/ac
Banvel $3.81 – 4.25/ac



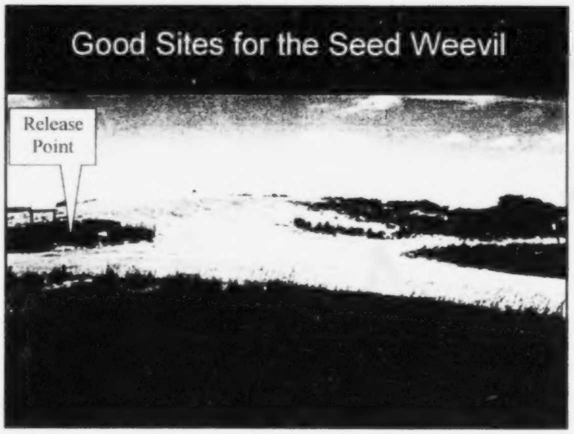
Industrial Weed Control (2003$)

Herbicide	Scentless Chamomile	Rate L or g/ac	Herbicide $/ac
Vanquish	Top Growth	0.51	$16.83
Escort	Control	8	$13.20
Tordon 22K	Control	0.45	$18.45
Transline	Control	.226	$30.51



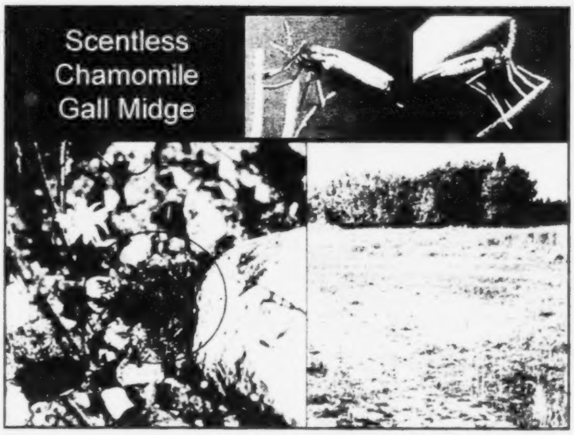
Scentless Chamomile (SC) Industrial Weed Control

Herbicide	Weeds Controlled	Rate L or g/ac	Herbicide $/ac
Vanquish $33.00/L	Top Growth (SC)	0.51	$16.83
Escort $1.65/g	Control (SC)	8	$13.20
Tordon 22K $41.00/L	Control (SC)	0.45	$18.45
Transline $135.00/L	Control (SC)	.23	[illegible]
Tordon 101 $15.00/L	Canada Thistle	1.48	$22.20
	Dandelion	1.48	$22.20
	Woody Plants	7.2 – 10	$108.00 – 150.00

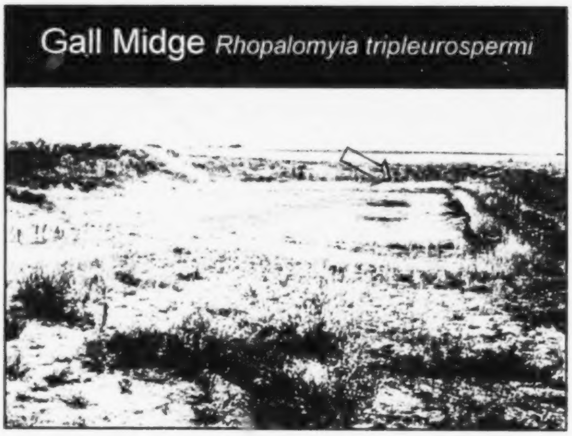


Good Sites for the Seed Weevil

Release Point



Scentless Chamomile Gall Midge



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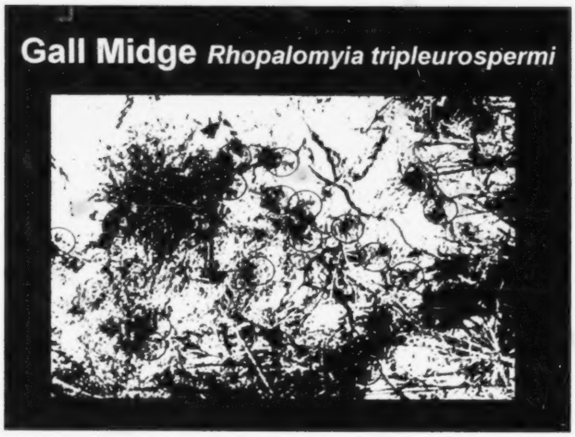

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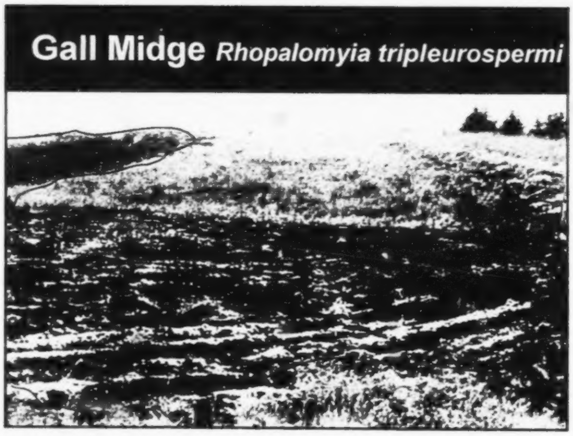

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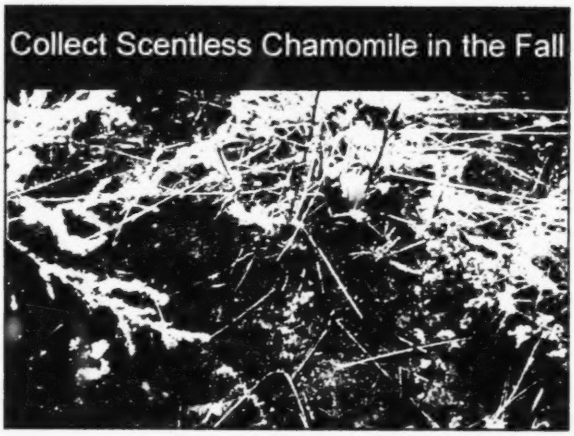

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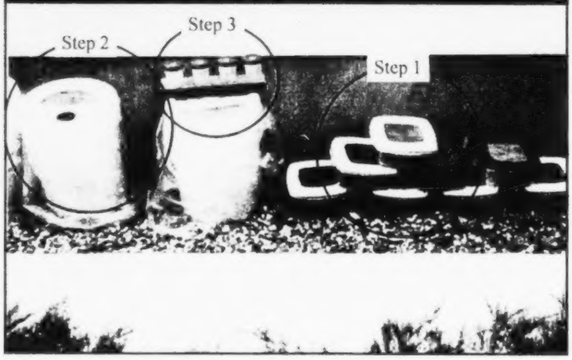


Annual Crop Weed Control
Scentless Chamomile (2002$)

	Cost ($/ac)		Cost ($/ac)
Absolute	$32.99	K2	$20.24
Achieve E_ G_	$16.15	Liberty	$13.70
Ally	$3.76 - 5.65	Lontrel	$24.25 – 47.93
Buctril M/Mextrol	$6.78 – 6.36	FlaxMax	$19.28 – 26.03
Champion E_	$21.80	Prestige	$14.25
Curtail M	$10.85	Prevail	$25.50
Harmony Total	$21.75	Refine Extra	$5.92
Hoe-Grass II	$19.39		
Horizon BTM	$22.50		

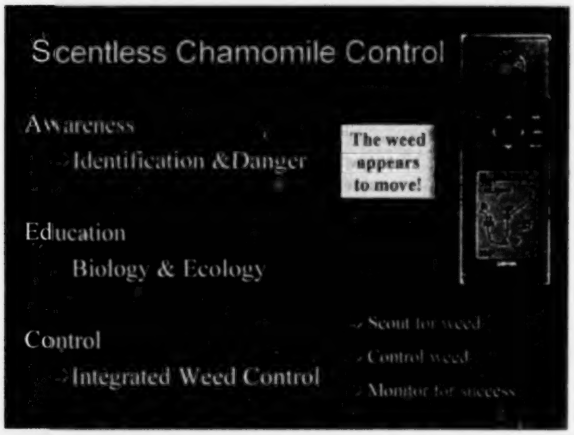
Common Herbicides	
2,4-D A	$1.57 – 4.29/ac
Banvel	$3.81 – 4.25/ac

Industrial Weed Control (2003$)

Herbicide	Scentless Chamomile	Rate L or g/ac	Herbicide $/ac
Vanquish	Top Growth	0.51	$16.83
Escort	Control	8	$13.20
Tordon 22K	Control	0.45	$18.45
Transline	Control	.226	$30.51

Scentless Chamomile (SC)
Industrial Weed Control

Herbicide	Weeds Controlled	Rate L or g/ac	Herbicide $/ac
Vanquish $33.00/L	Top Growth (SC)	0.51	$16.83
Escort $1.65/g	Control (SC)	8	$13.20
Tordon 22K $41.00/L	Control (SC)	0.45	$18.45
Transline $135.00/L	Control (SC)	.23	$31.05
Tordon 101 $15.00/L	Canada Thistle	1.48	$22.20
	Dandelion	1.48	$22.20
	Woody Plants	7.2 – 10	$108.00 – 150.00



Scentless Chamomile Control

Awareness

->Identification &Danger

Education

Biology & Ecology

Control

->Integrated Weed Control

The weed appears to move!

-> Scout for weed

-> Control weed

-> Monitor for success

Leafy Spurge Control

Leafy spurge is a herbaceous, long-lived, deep-rooted, aggressive perennial plant that can displace desirable plants that grow on abandoned land, pasture, rangeland, road rights-of-way and native habitats.

Leafy spurge is an invasive plant introduced from Eurasia and declared noxious under *The Noxious Weed Act, 1984*. It arrived in North America in the early 1800s and was first found in Saskatchewan in 1928.

Cattle avoid patches of leafy spurge that grow on grazing land. When leafy spurge covers more than 80% of the soil surface, the available grazing for cattle, horses and wildlife is nearly zero. The economic loss for cattle ranchers on land that is covered with leafy spurge is the ability to make a viable living. Sheep can tolerate leafy spurge as a portion of their diet and goats prefer it over grass.

The white 'latex-like' substance causes skin irritation or blistering in humans. Cattle and horses fed leafy spurge in hay can develop scours and weakness.

Leafy spurge is very invasive. It can spread up to 0.6 m per year from root expansion and seed can be propelled up to 4.5 m from the parent plant. Satellite patches merge quickly into solid stands that out compete forage grasses and legumes.

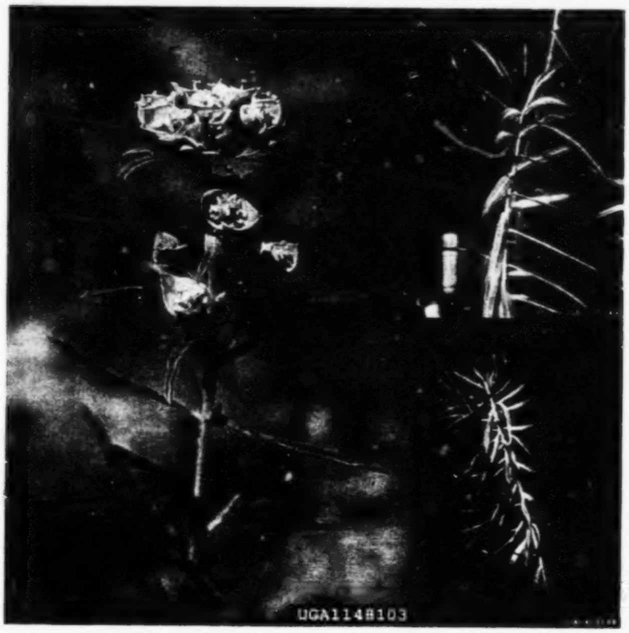


Figure1. Clockwise. Flower in June, spring foliage and fall foliage. Photos by USDA APHIS, N. E. Rees and W. M. Ciesla.

Identification

Each year leafy spurge grows 0.5 – 1.0 m tall from a crown, which is located below the soil surface and attached to a deep soil penetrating root system that also spreads laterally. Pinkish-red buds are present on the crown and spreading roots. The leaves are linear-shaped with smooth margins, dark green in the spring and turn to a reddish-orange in the fall (Figure 1). Distinctive greenish-yellow bracts grow under a group of flowers at the tip of a stem. The flower develops a capsule, which contains 3 grey-brown seeds. All parts of the plant contain white latex, which exudes when a plant part is broken.

Key characteristics for identification are multi-stem plants with pinkish-red buds on the crown, latex-like sap in all plant parts, characteristic greenish-yellow bracts in mid-June, three-sided capsules in July and reddish-orange leaves in the fall.

Strategy to Control Leafy Spurge

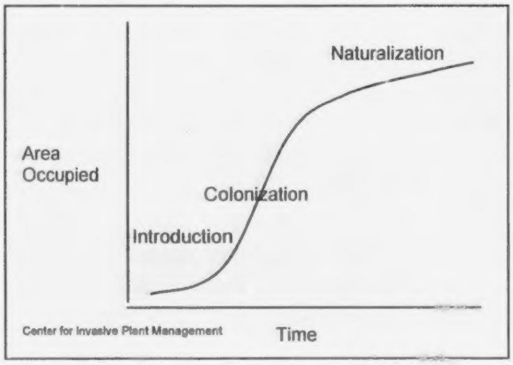
For land that harbours leafy spurge, develop a long-term (10-year) strategy to **Prevent, Eradicate** and/or when necessary **Contain** leafy spurge. After 10 years, there is no guarantee that the weed will disappear.

For effective 10-year control, **scout** for new weeds, **control** new infestations (never let seed set) and **monitor** for effective control. Scout when leafy spurge is most showy; greenish-yellow bracts in June and reddish-orange foliage in September. Control with the most appropriate method. When monitoring indicates unsatisfactory control, retreat or choose a new control method.

Prevent the movement of leafy spurge seed and plant parts from a known source to land where the weed does not grow.

- Do not knowingly purchase and sow field and forage crop seed that contain leafy spurge seeds. Purchase certified seed only after the Certificate of Purification has been inspected.
- Make sure that agricultural and industrial equipment is thoroughly cleaned at the previous work site before it is transported to your land.
- Avoid driving vehicles through leafy spurge patches when the capsules contain mature seed and when wet soil and dead plant debris adhere to tires. If transportation is necessary through leafy spurge patches then inspect and clean vehicles, including hay and grain haulers, when the units leave known leafy spurge sites.
- When moving livestock from an area with leafy spurge, quarantine them for 5 days to allow the passage of seed through digestive tracts. While in quarantine, feed livestock hay that is known to be free of leafy spurge seed.
- Do not move forage, straw, topsoil or gravel from an area that is known to harbour leafy spurge.
- Avoid dragging root pieces and crowns from leafy spurge patches across fields with tillage equipment.

Eradication should always be attempted when leafy spurge has only been established for a few years and has very limited distribution.



Center for Invasive Plant Management

Figure 2. Leafy spurge invasion occurs in three phases. Introduction lasts about four years with relatively slow growth and expansion. This is followed by Colonization, which is characterized by rapid expansion. Naturalization occurs when the weed grows over a large area and is considered to be part of the established vegetation.

Leafy spurge invasion of an area occurs in three phases: Introduction, Colonization and Naturalization (Figure 2). This best time for eradication of leafy spurge is during the Introduction phase, which can last up to four years.

For leafy spurge to establish at a new site, seed or plant parts (crown and root) must arrive from a distant infested area. In the case of seed, the environmental conditions must be favourable for germination and seedling establishment. In a right-of-way or pasture, a seedling must compete with established plants. The seedling develops a root that penetrates deep into the soil profile. From the vertical root, horizontal roots develop but the lateral spread of leafy spurge is minimal for about four years when the weed is growing in competition with native grasslands. During the Introduction phase, competition from established vegetation is important to reduce the number of surviving seedlings (Table 1).

Table 1. Importance of competition from an established grassland on leafy spurge seedling survival (2000 seeds planted fall of 1975 and seedling survival measured during fall of 1976)*.

Agricultural Activity on a Grassland	% Seedling Survival (after 1 yr)
Grassland; undisturbed	1
Grassland; clipped above litter	1
Grassland; clipped above soil (bare soil)	4
Grassland; sod dug out, roots removed, soil returned (cultivated)	68
Western Snowberry** patch	12

* Thomas and Bowes, unpublished ***Symphoricarpus occidentalis*

Often leafy spurge does not flower and set seed during the first year. Growth is slow. This is the best time to attempt eradication but there are several difficulties. Small leafy spurge plants are hard to find in established tame grasses and native vegetation. Seven to ten days after emergence, seedlings can reproduce new growth from roots. Any type of disturbance of the existing vegetation favours seedling establishment. The best chance for eradication is to continually control the weed with herbicides. Because treated sites are small, mark with a stake, record the position with a Global Position System (GPS) navigation receiver and sketch the area in a notebook to ensure all treated sites can be found quickly in the future and monitored.

The Colonization phase is characterized by rapid, often explosive growth which begins about four years after seedling establishment (Figure 2). Eradication is very difficult to nearly impossible because established deep rooted plants must be killed and the seed bank must be depleted of viable seed.

Rapid growth is thought to be related to a favourable habitat and the natural ability of the plant to spread rapidly because the competitive affect of the surrounding vegetation is minimal. In North Dakota, the radius of a patch expands about 0.6 m per year from lateral root growth. Each year, leafy spurge flowers and sets seed. The weed is easy to find in mid-June because it grows in patches and has flowers that have unique greenish-yellow colour bracts. A patch becomes the source for new infestations. Leafy spurge plants have a catapult-like mechanism in their capsules that can hurl seed up to 5 meters. Viable seed can remain in the soil seed bank for at least 8 years. Because most of the seed in soil remains viable after one year, the size of the soil seed bank increases every year that the weed sets seed.

For a well developed patch, a 10-year eradication or eradication-containment plan must be undertaken. Never let leafy spurge set seed. Always use herbicides to kill the established plants and all seedlings.

If possible, don't let leafy spurge naturalize (Figure 2). Leafy spurge becomes naturalized when it can self-perpetuate, disperse widely throughout a region and is part of the natural vegetation. Eradication is impossible when leafy spurge establishes over a large area.

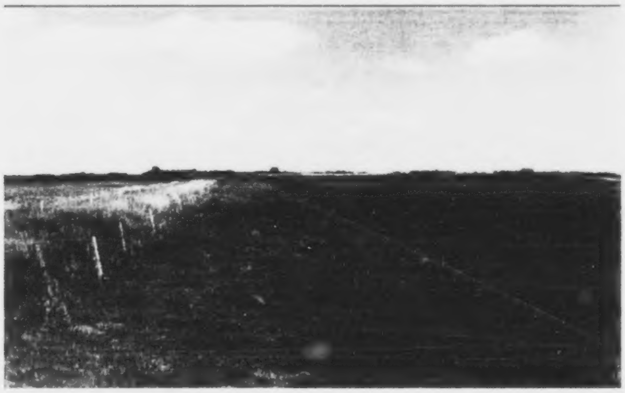


Figure 3. Leafy spurge is contained in a large area by a border that is kept free of the noxious weed by applying a herbicide when necessary. Photo by Garry Bowes, NWP.

Contain the spread of leafy spurge within boundaries once it becomes apparent the noxious weed can not be eradicated. Carefully scout the weedy site to establish a boundary around the weedy site, beyond which, leafy spurge should not be allowed to establish (Figure 3).

Outside the boundary, yearly scouting is needed to prevent weed spread. Scouting should be sufficient to find small isolated weed patches so that eradication can be attempted. In addition, the movement of animals, products and machinery from a leafy spurge area should be restricted. Border areas that are monitored should be at least 10 m wide to spot plants that start from seeds propelled from the edge of a containment area.

If a double border is maintained (20 m), it may be possible to gradually shrink the containment area by moving the boundary line in by 10 m every 10 years. The entire area outside of the boundary should still be monitored for the occasional new patch starting from long-dormant seeds or seeds moved by wildlife.

Inside the boundary, leafy spurge may continue to spread and dominate. Control leafy spurge to prevent seed set and reduce weed density. Control is on-going because viable seed in the soil can germinate for at least eight years, producing new seedlings (Table 2).

Table 2. Leafy spurge seeds capable of germination after control treatments*

Treatment	Number of Seeds/m^2
Untreated	15,150
Tordon 22K; control 1973 - 1975	11,383
Untreated	5,454
Tordon 22K; control 1973 - 1976	3,522
Eight years of continuous sheep grazing	15

*Bowes and Thomas 1978

Integrated Weed Control

Leafy spurge is very difficult and costly to control. There is no single control method that will always be effective. Successful control depends on a long-term plan that combines the use of biological control agents, herbicides and mechanical equipment. This is called integrated weed control. Key to using an integrated approach is the understanding of the strengths and weaknesses of each control method and how two or more methods can be complimentary.

Sanitation

Ensuring that areas without leafy spurge are protected from its introduction is more cost and time effective than an annual expense and effort to control an established weed. Prevent the introduction of unwanted weeds by ensuring that good sanitation practices are followed. Sanitation includes cleaning vehicles and equipment before leaving each job and requesting that those working on your land do so before leaving their previous project. Good sanitation measures also include taking care to purchase feed or seed that is not contaminated with reproductive parts or seed. Ensure that purchased feed material was processed using heat or ammonization to destroy the viability of seed or other reproductive parts.

Manual and Mechanical Control

Unsustained top-growth removal is not an effective control method. The root can not be pulled from soil. New shoots are initiated from root tissue 2 to 4 weeks after pulling. Mowing prevents leafy spurge from setting seed. Repeated mowing, as required, throughout the growing season will prevent seed set. Leafy spurge plants are not killed.

Tillage can be effective if used every 3 to 4 weeks throughout the growing season. Before selecting tillage as a control, assess the weedy site to ensure the soil and terrain can sustain multiple tillage treatments for at least two years. Sandy soils and sites with a steep slope are prone to erosion. When using tillage be careful not to spread root fragments from leafy spurge patches throughout a field.

Herbicides

For herbicides to control leafy spurge, they must kill the top-growth, crown and deep penetrating roots which produce laterals. Any part of the extensive root system that is not killed by a herbicide treatment is capable of producing a shoot. Read the label on a herbicide container for the degree of control (control, top-growth control, or suppression) expected from the herbicide. Several but an unknown number of herbicide treatments are required during a ten-year control plan because each year, it is possible that some of the viable seed in the soil will germinate and produce seedlings that left unchecked, will go on to produce another patch.

2, 4-D amine: Apply at 4.5 L/ha at early flowering stage for top-growth control on non-crop areas, pastures and roadsides.

Amitrol 240: Apply 37.5 to 45.75 L/ha between the advanced flowering and early seed development stage on non-crop areas. At high rates Amitrol 240 is a non-selective herbicide. Treated areas should not be mowed for at least 3 weeks after treatment or after top growth is bleached. Spot treat where regrowth appears or re-spray with half original rate. Spot treat regrowth the following year.

Tordon 22K: Apply at 9 L/ha for the control of patches on non-cropland, permanent grass pastures and rangeland, and as a spot treatment on cultivated cropland when applied by an authorized pesticide applicator.

Vanquish: Apply at 1.25 L/ha when the weed is actively growing for top growth control on non-cropland.

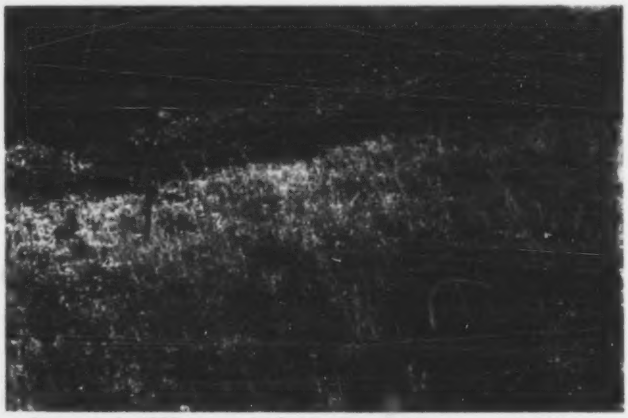


Figure 4. In 1996, brown dot flea beetles (*Aphthona cyparissiae*) were released at the stake. In the nearby area, many releases including black flea beetles (*A. nigriscutis*) and black dot (*A. lacertosa*) were made. During 2003, only black flea beetles were found on the site. Photo by Garry Bowes, NWP.

Biological Control

Biological control is the use the natural enemies of leafy spurge to suppress the weed. Several species of *Aphthona* flea beetles feed on the roots of leafy spurge and suppress the weed. When successful, small populations of the weed and flea beetles will always be present. On-going seed germination and seedling establishment ensure the weed will be present in the future.

Whereas leafy spurge was introduced to North America from Europe and Asia by an unknown voyage, the *Aphthona* flea beetles were introduced to North America only after they were found to eat only leafy spurge.

The success of the flea beetles depends on the local environmental conditions (Figure 4). The black flea beetle (*Aphthona lacertosa*) is black, 3 – 4 mm long, prefers moist clay-loam soil and can tolerate some shading and spring flooding. The brown dot flea beetle (*A. cyparissiae*) is rusty brown with a brown dot behind its head, 2 – 4 mm long and prefers sandy to sandy loam soils. The black dot flea beetle (*A. nigriscutis*) is rusty brown with a black dot behind its head, 2 – 4 mm long and likes full sun on sandy soils. Releases of brown and black dot flea beetles are more successful on the edges of thick leafy spurge stands since they do not tolerate shade well.

In Saskatchewan, municipalities have been supplied a provincial list of known flea beetle release sites. Obtain permission for access from a land owner, before entering a release site. Start in July to monitor adult beetle density and collect, with a sweep net, when numbers are high. Collect early to ensure that the females, when transported to a new site, have an adequate amount of eggs to lay and sustain a future population. Try to collect and release at least 1,000 flea beetles at a release point (a 35 mm film canister holds ~3000 beetles). To release the healthiest flea beetles, always minimize the time between collection and release. More flea beetles per release and many releases are always better. Flea beetles are sociable so release them in a small area. Do not spread them at a release site.

The release site should be the best possible habitat for the flea beetles. Release near the south edge of a patch with a moderate stem density, on a south facing slope and in sun. Then, let the flea beetles work their way into dense weed stands and shady moist areas (Figure 4).

Ecological Control

Competition from grasslands is most intense when leafy spurge is a seedling. After a control treatment, a competitive stand of grass will reduce the number of seedlings that establish. Once leafy spurge forms a patch and starts to spread, it can dominate established vegetation. Any disturbance of vegetation cover favours leafy spurge.

Figure 5. Goats effective control the top growth of leafy spurge by selecting the weed over grasses. Photo by Garry Bowes, NWP.

The eating of leafy spurge foliage by sheep and goats controls the weeds top growth (Figure 5). Sheep and goat grazing does not eradicate leafy spurge but prevents flowering and seed set, reduces weed density, slows spread and allows grasses to be available for cattle and horse grazing. After 10 years of sheep grazing, there will be a few shoots of leafy spurge appearing in grasslands.

Integrated Weed Control Examples

For integrated weed control of leafy spurge, plan to use control methods side by side as well as on the same site, which applies multiple stresses on the weed.

For isolated plants, small isolated patches or patches outside the boundary of a large containment area for leafy spurge, where the weed has been established for a short time, apply a herbicide to kill leafy spurge. Make sure that sites where leafy spurge has been killed have competitive grasses to reduce the number of establishing seedlings. Use this method to attempt eradication. Mark herbicide treated sites with a stake or by coordinates from a GPS unit, and sketch the area for quick efficient monitoring in the future. Should leafy spurge plants continually appear, use repeat herbicide treatments, as required, to kill the weed and never let it set seed.

For large areas, develop a 10-year plan to contain the weed within a boundary. Remember, seed can remain viable in soil for up to 8 years and root growth in soil is massive, deep and can produce vegetative shoots. Choose the most appropriate integrated control method. Be prepared to apply a control treatment(s), every year, for at least ten years. At the end of the tenth year of a control program, some leafy spurge plants will most likely still be present.

Use mowing to prevent flowering, seed set and spread in pastures, along ditches and other non-agricultural sites where herbicide treatments are not appropriate. Do not mow once seed has formed since this may only spread the weed from the existing infestation. Yellow or partially yellow seed in a "soft dough" stage (capsules are easily cut with a fingernail) are immature and do not germinate. When the capsule is hard to cut with a fingernail, the seed is viable. All leafy spurge seed does not germinate at the same time so perform the "soft dough fingernail test" on the first formed capsule of several plants. Use herbicides to control leafy spurge where the risk of spread is high and on sites where the treatment is economically justified. Read the label on herbicide containers for information on areas where herbicides should not be applied. Release biological control agents, like the *Aphthona* flea beetles, on very large areas with leafy spurge. For the most effective use of flea beetles make dozens of releases every year for several years in the best habitat for the flea beetles. Release multiple species at a site. This practice allows for the establishment of the species that is best suited for the microenvironment of a site. Usually, *Aphthona* flea beetles are not effective for weed eradication, but lessen the impact of the weed to the environment it infests.

Sometimes, to prevent leafy spurge from spreading, it may be necessary to mow or apply herbicides on sites where flea beetles have established. Often, on these sites, the flea beetles have established but the degree of suppression has not met the land owner's expectation. Research in Saskatchewan is limited on the integration of mowing, herbicides and flea beetles, but in North Dakota the best time to mow is in the spring and apply a herbicide is fall. Time the mowing so that new leafy spurge growth is present in July to feed adults when they are laying eggs. Apply herbicide treatments in September after the adults have laid their full compliment of eggs. In this example of integrated control, choose a herbicide that allows some leafy spurge foliage growth during the next growing season.

With any control treatment always limit vegetation disturbance as much as possible to maximize the competitive effect of perennial grasses on leafy spurge seedlings.

Sheep and goats can be used to control leafy spurge growing in large areas, in rough topography, along waterways and under trees. *Aphthona* flea beetles are complementary with sheep and goat grazing, as long as proper grazing rates and time of grazing are used, which will always leave some leafy spurge foliage for adult flea beetle feeding and egg laying in July.

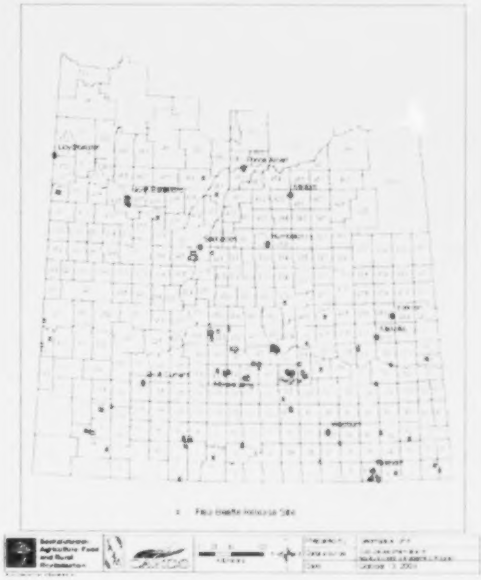
Prepared by Garry Bowes
Noxious Weed Program
3830 Thatcher Avenue
Saskatoon, SK
S7K 2H6

p 306 933-7695
f 306 933-7352
i gbowes@agr.gov.sk.ca

Where, When and How to Collect and Release Leafy Spurge Flea Beetles

Leafy spurge flea beetles are biological control agents that feed exclusively on leafy spurge. Adult flea beetles feed on the leaves of leafy spurge but it is the larvae that feed on roots that damage the plant. Year after year the roots are continually defragmented. patches gradually thin and fewer seeds are produced, which reduces the competitive advantage of the noxious weed. Desirable plants that were present before leafy spurge invaded gradually increase in abundance and thrive.

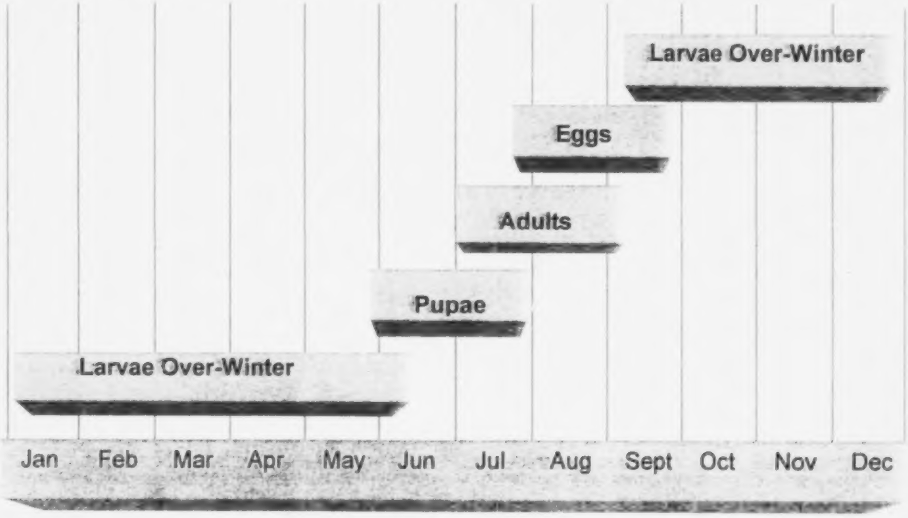
Figure 1. Flea beetle release sites



Three biological control agents can be collected and released to suppress leafy spurge. The agents are the Brown Dot (*Aphthona cyparissiae*), Black Dot (*A. nigriscutis*) and Black (*A. lacertosa*) Leafy Spurge Flea Beetle. Many sites shown in Figure 1 have a mixture of beetle species.

Figure 2 shows the life cycle of the flea beetles which over winter as larvae in soil near leafy spurge roots. In the spring as the soil warms up, the larvae become active and begin to feed on leafy spurge

Figure 2. Leafy spurge flea beetle life cycle



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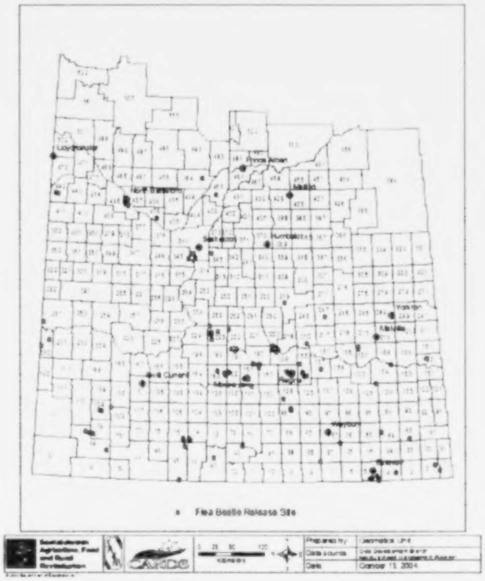

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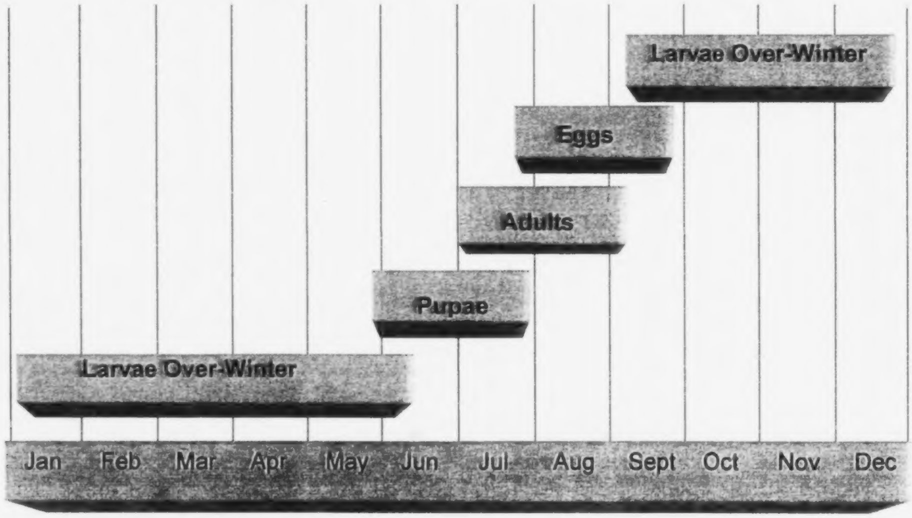


roots. The larvae pupate for 28 to 57 days in the spring. Adult flea beetles emerge from the pupa stage in July and begin to feed on the leaves of leafy spurge. During a warm spring season, adults emerge around the first week in July but emergence can be delayed two to three weeks when spring weather is cold. Females lay 200 to 300 eggs underground near the crown of the plant. The eggs hatch larvae in 17 days at 20 C. Newly hatched larvae eat first year roots and as the larvae mature they feed on the older roots. In the fall as the soil becomes progressively colder the larvae move deeper in the soil for the winter.

Adult flea beetles can be collected at release sites when they emerge in late June and July. Adults feed on the leaves of leafy spurge and are active on warm sunny days. Emergence is staggered so it is important to sample for the size of the adult population on several consecutive warm sunny days. When a sufficient number of adults have emerged they can be captured in a sweep net and moved to a new location.

Plan for Collection Procedure

1. From the author or a local person who has collected and released flea beetles, find a site that is thought to have a sufficient number of the insects for collection
2. Phone the owner or occupier of the land where the collection site is located and request permission to enter the site and collect flea beetles
3. In the spring, before the anticipated time for flea beetle collection (July), obtain the equipment that is necessary for collection
4. Starting near the end of June, sample the chosen collection site at regular intervals to determine the best time to collect
5. Be prepared to collect flea beetles on a warm day with low wind when more than 2000 to 3000 can be collected per hour
6. Release the beetles as soon as possible after collection on a pre-determined release site
7. Mark the site with a stake or preferably by coordinates from a Global Position System (GPS) navigation receiver

Collection Equipment

1. One sweep net per person
2. Several PVC collection tubes*
3. Large plastic bags for collection tubes
4. Heavy duty paper bags for beetle storage
5. Duck tape
6. Cooler with blue ice (frozen)

* Must be constructed

Collection Procedure

Flea beetles are collected by moving a sweep net in a back and forth motion as shown in Figure 3. The sweep nets are available from Pro Metal Industries in Regina for about $40. Figure 4 shows flea beetles trying to escape from the sweep net. During sweeping the flea beetles will remain at the bottom of the net but when sweeping stops the flea beetles want to crawl out. When the weight of the debris and flea beetles becomes excessive in the sweep net, shake the flea beetles from the large debris and remove the debris from the sweep net as shown in Figure 5.

Figure 3. Collecting flea beetles with a sweep net

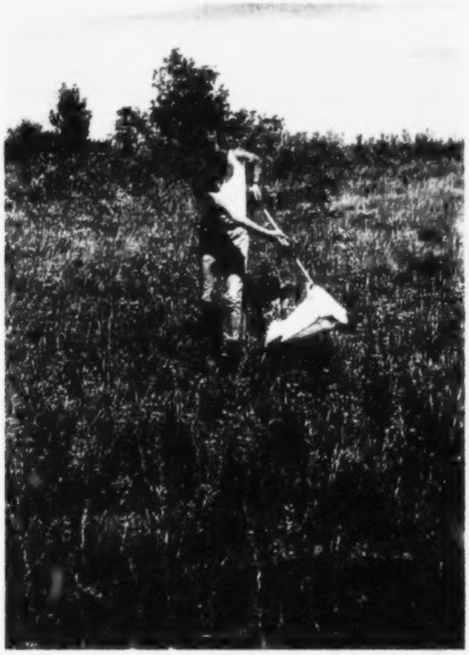


Figure 4. Flea Beetles in the sweep net

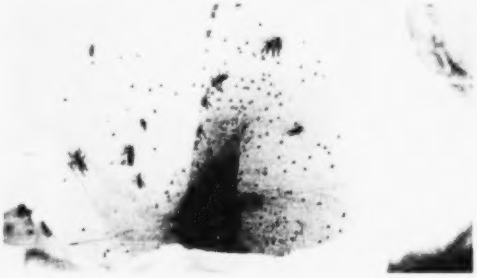
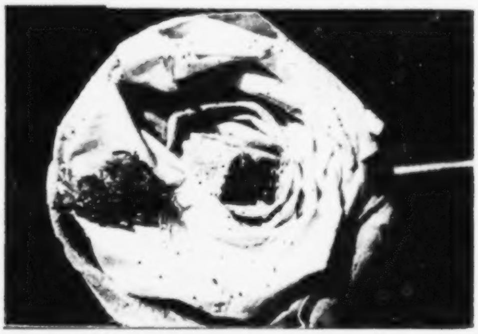


Figure 5. Debris removed from sweep net



Dump the contents containing the flea beetles, from the sweep net in to a PVC collection tube as shown in Figure 6.

Before the collection season starts, construct several collection tubes by drilling 1/8 to 3/16 inch holes, on 1 inch centre, in a 3 inch PVC pipe and cap each end of the tube. The collection tube shown in Figure 7 is 22 inches long. A sweeper can use 2 to 3 collection tubes.

Figure 6. Dump flea beetles from a sweep net into a collection tube

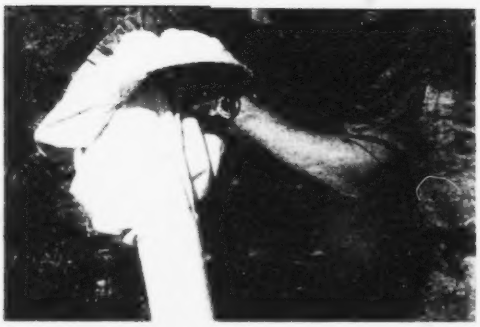
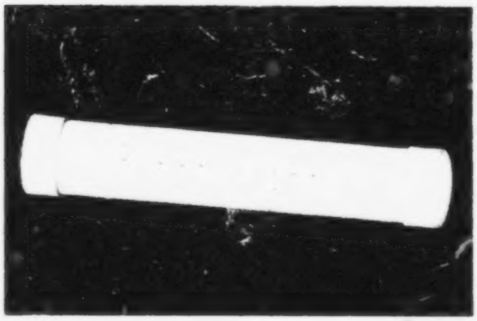


Figure 7. Flea beetle collection tube



Place the collection tube in a clear large plastic bag and close the bag tightly to prevent flea beetle escape. Figure 8 show flea beetles emerging from the collection tube and being contained in a clear plastic bag. Continue to sweep for more flea beetles, quickly open the plastic bag and add the contents of the sweep to the collection tube.

When only a few beetles are crawling through the holes, carefully open the plastic bag as shown in Figure 9. Use your hand to brush the beetles off the tube into the plastic bag. Remove the collection tube from the plastic bag. Close the plastic bag to prevent the flea beetles from escaping. The plastic bag contains a nearly pure collection of flea beetles.

Remove the debris from the collection tube and leave it at the collection area. The debris may contain weed seeds that that should not be transported from the collection site.

Shake the flea beetles in the plastic bag until most of them are together in one corner of the plastic bag as shown in Figure 10.

Figure 8. Flea beetles crawl out of the collection tube in to the plastic bag

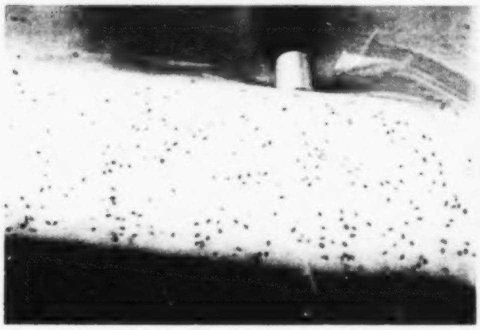


Figure 9. Wipe the flea beetles from the collection tube with your hand in to the plastic bag

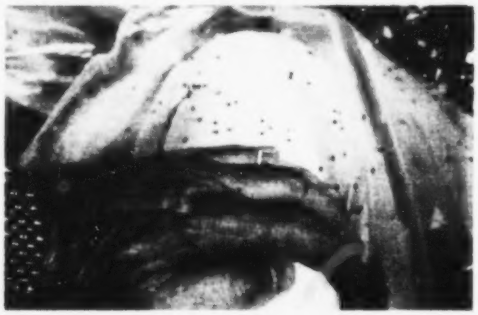


Figure 10. Shake the flea beetles to the bottom of the plastic bag

Figure 11. Measure the number of beetles when they are scooped out of the bag with a 35 mm file cassette holder

Use a 35 mm film cassette holder to measure the quantity of flea beetles collected. A film cassette holds about 3000 flea beetles. The sizes of the black dot, brown dot and black flea beetles are similar. Figure 11 shows how to scoop up beetles after they have been shaken to a corner of a plastic bag. Quickly dump 1000 to 2000 flea beetles from the film cassette into a container for transport to a release site or the insects will escape as shown in Figure 12.

Good quality paper bags are suitable for containing leafy spurge beetles for transport to a release site. Figure 13 shows a few sprigs of leafy spurge that are placed in a paper bag to feed the flea beetles during transport to a release site.

Figure 12. Quickly move the flea beetles from the plastic bag to a paper bag or they will escape

Figure 13. Dump flea beetles in to a paper bag for transport to a release site

Figure 14. Close paper bag tightly and duck tape to prevent the flea beetles from escaping

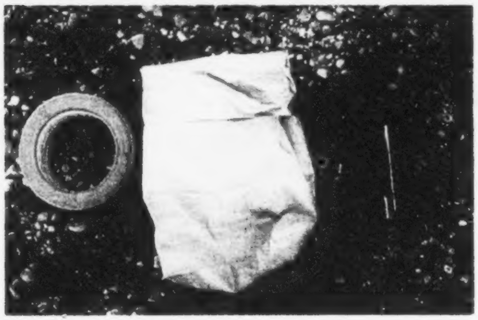
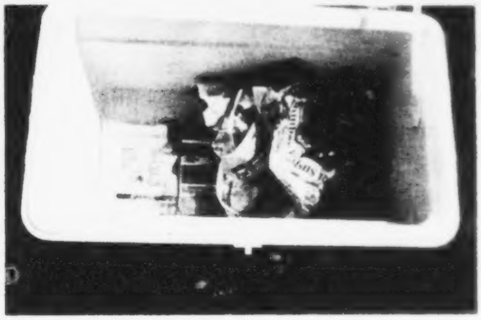


Figure 15. An ice chest with frozen ice packs and crumpled paper



To prevent flea beetles from escaping from the paper bag secured it shut with paper staples and duck taped as shown in Figure 14.

Place the sealed paper bags with the flea beetles on crumpled paper, which is on top of frozen ice packs in an ice chest for transport from the collection site to the release site. Figure 15 shows crumpled paper on frozen ice packs in an ice chest. Ice packs are preferred over ice because melted ice water can drown the flea beetles. Crumpled paper is placed on the ice packs to prevent the flea beetles from freezing. Place the paper bags containing the flea beetles on the crumpled paper as shown in Figure 16.

Figure 16. Sealed paper bags placed on crumpled paper and ready for transport

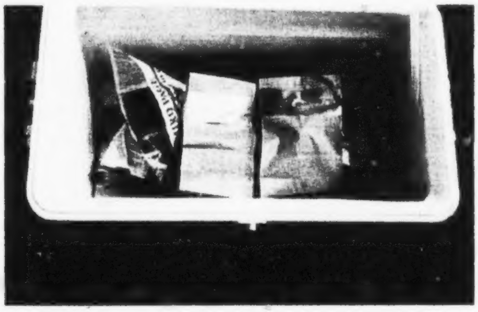


Figure 17. At the release site open the paper bag and release the flea beetles

At the release site, open up the paper bag and let the flea beetles exit as shown in Figure 17. The preferred release point is at the southern edge of a leafy spurge patch. After 10 – 15 minutes, shake out the flea beetles that remain in the paper bag near the release point. Mark the release point with a stake and if possible GPS the release point for future monitoring for establishment success and possible future collection.

Prepared by Garry Bowes, Noxious Weed Program
Phone: 306 933-7695, Internet: gbowes@agr.gov.sk.ca

Where, When and How to Collect and Release Scentless Chamomile Seed Weevils

The scentless chamomile seed weevil is a biological control agent for scentless chamomile. The weevils reduce the number of seeds that a plant can produce by eating florets and immature seed. One weevil eats 11 seeds.

There are 116 known seed weevil release sites in the province. The distribution of the release sites is shown in Figure 1.

Each year, there is one generation of seed weevils. The life cycle for the seed weevil is shown in Figure 2 and an adult is shown in Figure 3. Adult seed weevils over-winter in the soil. During May adults emerge from the soil and feed on scentless chamomile plants. When scentless chamomile is in the flower bud stage, seed weevils lay eggs in the flower. The eggs hatch and the newly hatched larvae begin

Figure 1. Seed weevil release sites in Saskatchewan

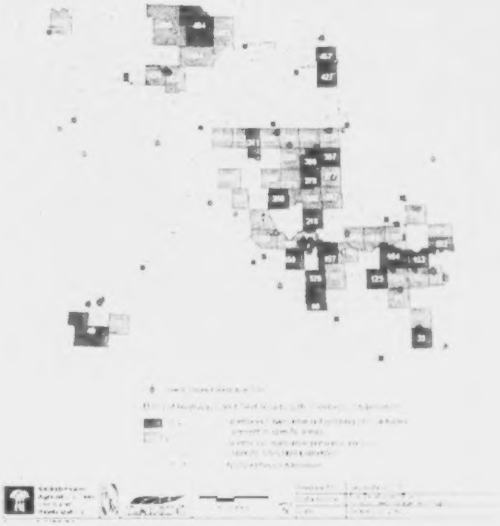
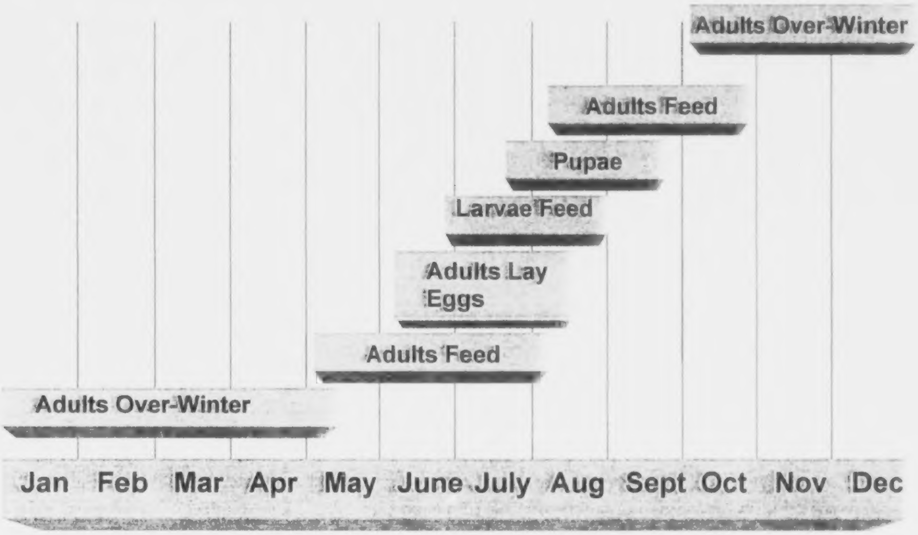


Figure 2. Scentless Chamomile Seed Weevil Life Cycle



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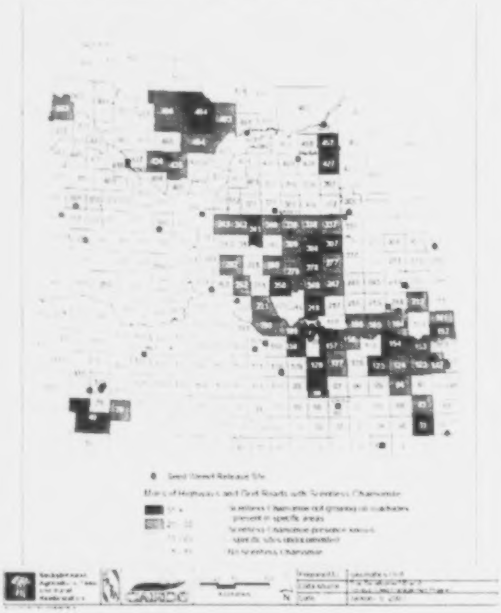

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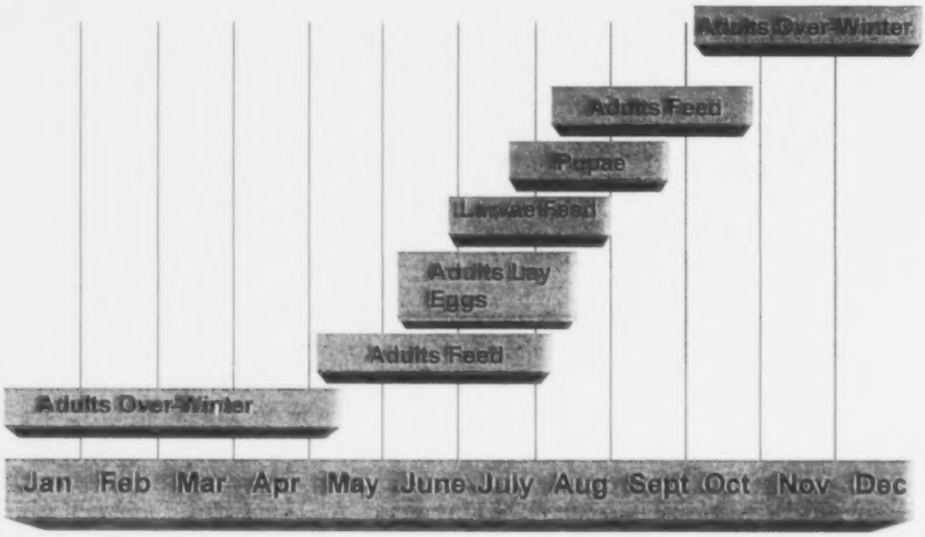
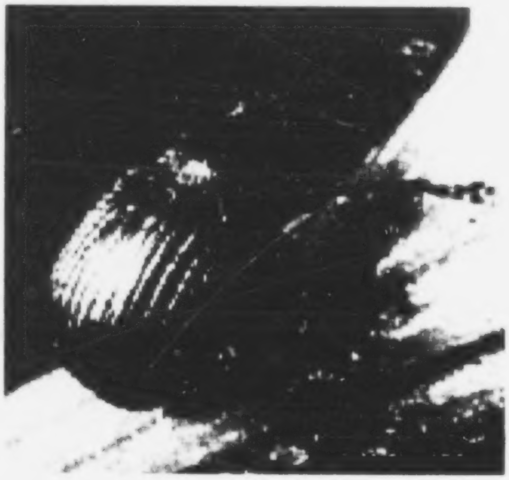


to eat the floret in the seed head. In July the larvae pupate in the flower-seed head. Adults begin to emerge from the seed head in August.

Seed weevils can be collected at a release site when they are laying eggs (June Collection) and when they are adults in a scentless chamomile seed head (August Collection). August collection is easier.

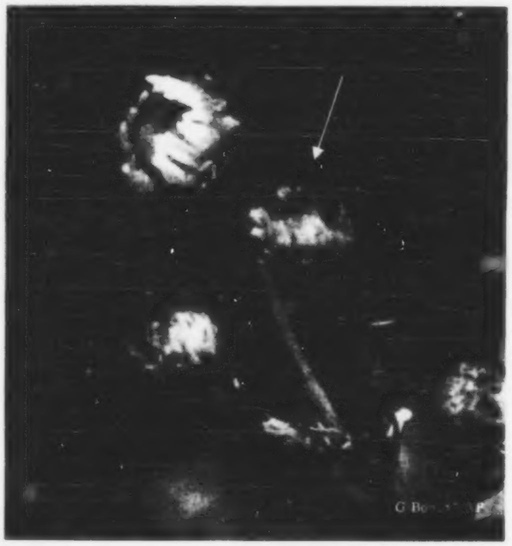
Figure 3. Adult scentless chamomile seed weevil



Collection Procedure

1. Locate a site for collection where seed weevils are known to have established (a list of locations is available from the author)
2. Phone the person responsible for the release site, most often the landowner, for permission to enter the site and collect
3. Obtain the necessary material to collect and release seed weevils
4. Collect the seed weevils during either June or August
5. Release the adults as soon as possible after collection on pre-determined release sites
6. Use a stake to mark the release site

Figure 4. Best time to collect weevils

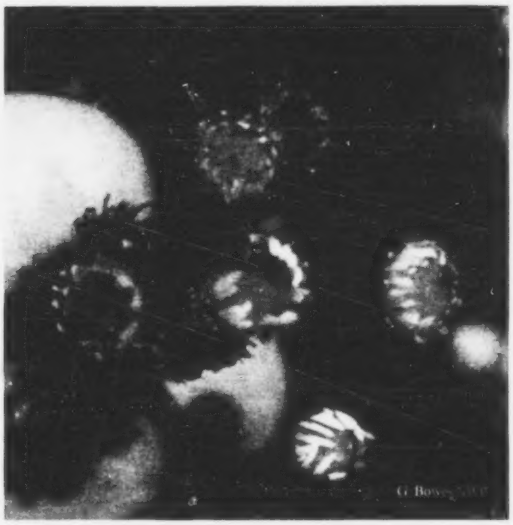


June Seed Weevil Collection

Seed weevils can be collected on scentless chamomile plants when the flower bud starts to open until the white petals are about 1 cm in length. Figure 4 shows seed weevils laying eggs at the early bud stage of scentless chamomile.

Seed weevils are available for collecting as they continue to lay eggs in young scentless chamomile flowers. Notice in Figure 5 that there are no seed weevils on the oldest flowers in the photo. The flowers in the middle, at the bottom and

Figure 5. Seed weevils laying eggs


G. Bowes [illegible]

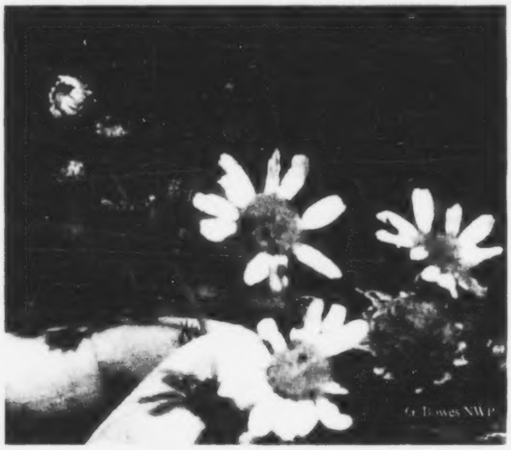
the one on the right are too advanced for egg laying.

Seed weevils can be collected in June when they are laying eggs. Be careful when collecting. Seed weevils are easily knocked off the plant.

Figure 6 shows a scentless chamomile plants which has a flower in the lower right that is starting to turn from yellow to brown. Neighbouring flowers on the same stock are in full bloom. In the upper left of the photo is a flower stock from the middle of a plant that has flower buds with seed weevils.

To collect seed weevils from a plant that is similar to the one shown in Figure 6, you must look into a stand of scentless chamomile. When you reach down and select a plant branch which has seed weevils, some may fall off. Also, these weevils may have laid most of their eggs. The best time to collect is after the first few flowers have opened when the adult contain most of their eggs.

Figure 6. Seed weevil laying eggs on a scentless chamomile plant with mature flowers


G. Bowes NWP

June Collection Method

1. Equipment needed for collection
   a. Collection containers such as old plastic pill bottles, margarine or honey containers
   b. Make small holes in the top of the containers for air exchange
   c. Artist print brush or scissors
   d. Cooler
   e. Frozen ice packs
   f. Old newspaper

2. Place small sprigs of scentless chamomile leaves in the collection container to slow the escape of seed weevils

3. Use an artist print brush to brush seed weevils from the flower bud to the collection container or cut off flower buds with scissors (This is more destructive than using an artists brush)

4. The collection container cannot be left unsupervised because the adults are very active and will escape

5. As soon as possible transport the seed weevils from the collection site to the release point

6. For transport on hot days and over night, place the collection container with the weevils in a cooler with ice packs

7. The temperature in the cooler should not be lower than 4°C

8. Use ice packs rather than ice (frozen water) to reduce the risk of melt water drowning the weevils

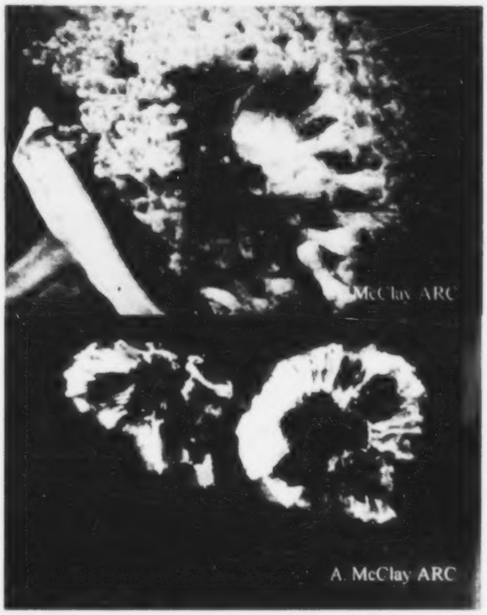
9. Place old newspaper between the ice packs and collection containers to reduce the risk of the weevil freezing

August Seed Weevil Collection

Seed weevils can be collected when they are adults, before they emerge from a seed head. Collect entire seed heads and transport them to the release point.

Figure 7 (upper) shows the variation in the colour of a mature flower from dark yellow to light brown when the seed weevils have pupated and are adults. The bottom photo in Figure 7 shows adults and the cavity they form from eating immature seeds of scentless chamomile.

Figure 7. Side view (upper) and cross-section (lower) of a mature flower-seed head of scentless chamomile that contain adult seed weevils



August Collection Method

1. Equipment needed for collection
    a. Collection containers, good quality paper bags
    b. Paper stapler
    c. Duck tape
    d. Cooler
    e. Frozen ice packs
    f. Old newspaper

2. Before starting to collect seed heads, sample the collection site for adult weevils

3. Collect a sample of 40 scentless chamomile seed head, dissect each

seed head with sharp scissors or a knife and count the mature adult seed weevils

4. The purpose of a sample is to avoid collecting from a site that has a high percentage of uninfested seed heads

5. **A site is suitable for collection when the seed weevils are present in over 50% of 40 randomly sampled seed heads**

6. Collect a sufficient number of seed heads to ensure there are at least 100 adults then close the paper bag by turning the top of the bag over, staple shut and secure with duck tape

7. The collection container cannot be left unsupervised because the adults are very active and will escape

8. As soon as possible transport the seed weevils from the collection site to the release point

Keys to Successful Establishment

1. Release the seed weevils as soon as possible after they are collected

2. If the seed weevils can not be released until the day after they are collected then store them in a cooler with ice packs or in a fridge where the temperature is not less than 4^{0} C

3. Hot temperatures (>28^{0}C) at release can dramatically increase seed weevil mortality so on hot days release the insects in the evening

4. Cool temperatures (<18^{0}C) are not beneficial for a release because the seed weevils are not very active

Selecting the Release Point

1. Release seed weevils at a site with a good stand of scentless chamomile that can be left undisturbed for 3 to 5 years

2. Do not release seed weevils near anthills or wasp nests

How to Release Seed Weevils

1. Release the seed weevils near the centre of a scentless chamomile stand

2. Opened the shipping container, place it on the soil surface and leave undisturbed for 10-15 minutes to allow the insects to adjust to their new environment

3. After 15 minutes, gently shake the remaining insects out within 1-3 metres of the release point to reduce the risk of mortality from predacious insects

4. Mark the release location with a clearly visible stake

Evidence of Scentless Chamomile Seed Weevil Damage

The presence of adult seed weevils on scentless chamomile plants in June and July is evidence that the biological control agent is attacking the weed. Look for the presence of adult weevils, which are shown in Figure 3, on flower buds and flowers similar to the photos shown in Figures 4 to 6. To find weevils in mid-July, look for the newest flower that is produced on a stem.

For evidence of seed weevil damage wait until the seed head starts to mature in August. Dissect seed heads and look for adult weevils or cavities, which once contained weevils. One cavity once contained one weevil. On average one seed weevil consumes 11 seed and there are on average 171 seeds in a scentless chamomile seed head.

Scentless chamomile seed does not shatter from a head until some force exerts a sharp blow on the plants. Figure 8 shows intact seeds heads of scentless chamomile in the late fall. These seed heads show no evidence of seed weevil damage.

The best time to look for evidence of seed weevil damage on scentless chamomile is in late fall and early spring.

Figure 9 shows an intact seed head (left) and a seed head with at least 5 cavities (upper right). Evidence of damage in the other seed head (lower right) is not clear because most of the seed has shattered. The photos in Figure 9 were taken in early May.

Prepared by Garry Bowes, Noxious Weed Program
Phone: 306 933-7695, Internet: gbowes@agr.gov.sk.ca

Figure 9. A normal scentless chamomile seed head (left) and seed heads with seed weevil cavities (right)

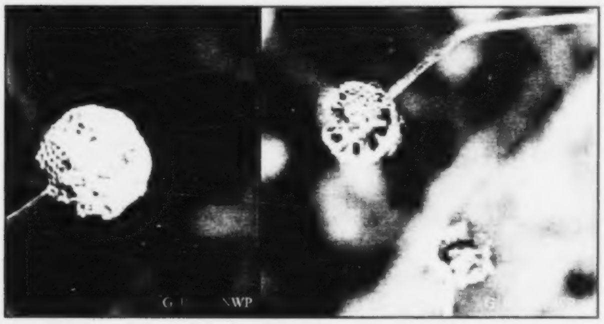


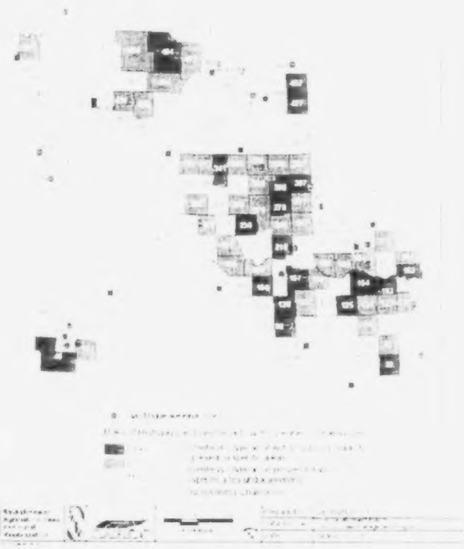
Figure 8. Scentless chamomile seed heads are often intact when there is snow on the ground

Where, When and How to Collect and Release Scentless Chamomile Gall Midges

The scentless chamomile gall midge is an insect that will only attack scentless chamomile. Gall midge larvae cause the formation of a gall on a growing point, in a leaf axial and on a flower of scentless chamomile. The formation of a gall changes the architecture of scentless chamomile by reducing plant height.

Gall midges spread at the rate of about 5.2 km per year. The spread of the insect can be increased by moving them in either the spring or fall. Gall midges are moved by transplanting scentless chamomile plants that have healthy looking galls. There are 116 known gall midge release sites in the province and their distribution is shown in Figure 1.

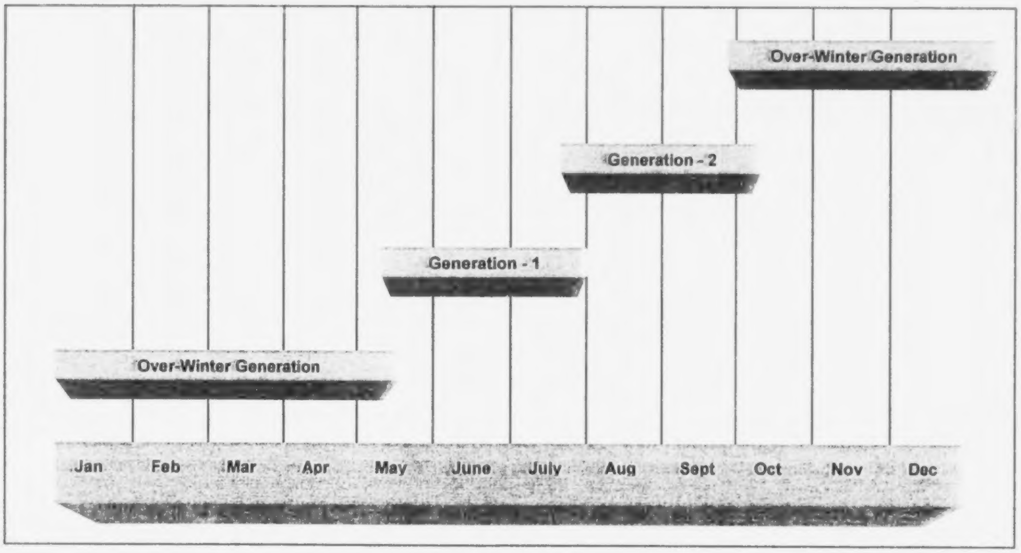
Figure 1 Gall midge release sites in Saskatchewan



Gall Midge Life Cycle

There are 2 and in some years 3 generations of the gall midge per year. The life cycle of

Figure 2. Gall midge life cycle



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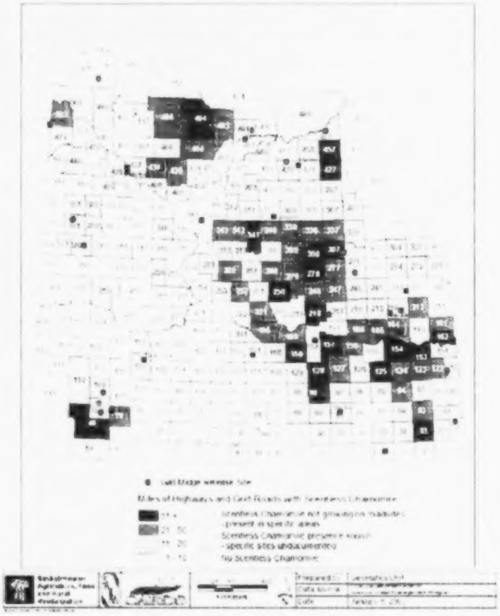

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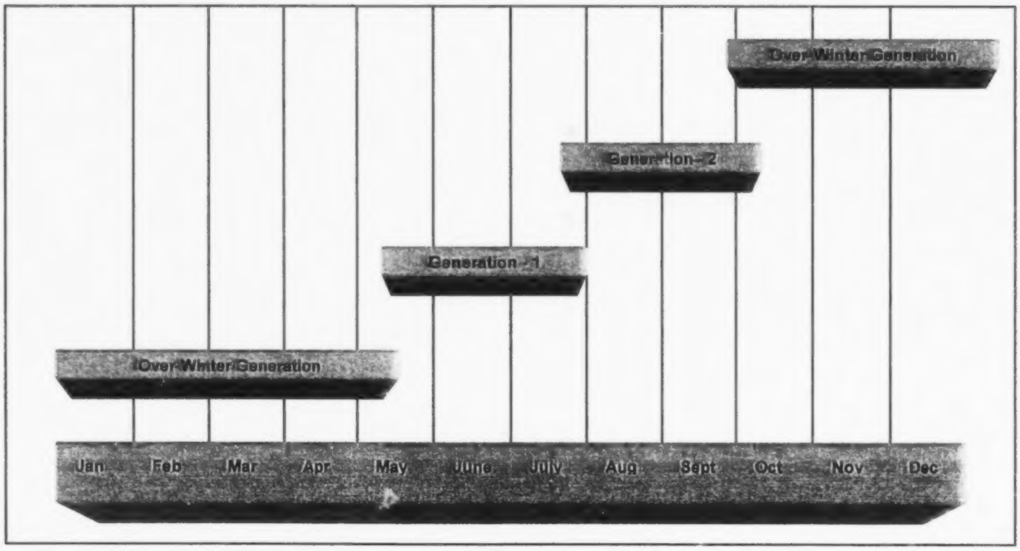
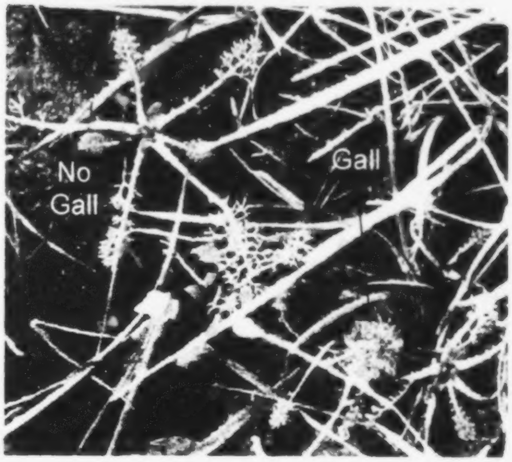


the gall midge is shown in Figure 2.

Figure 3. A gall on a rosette of scentless chamomile

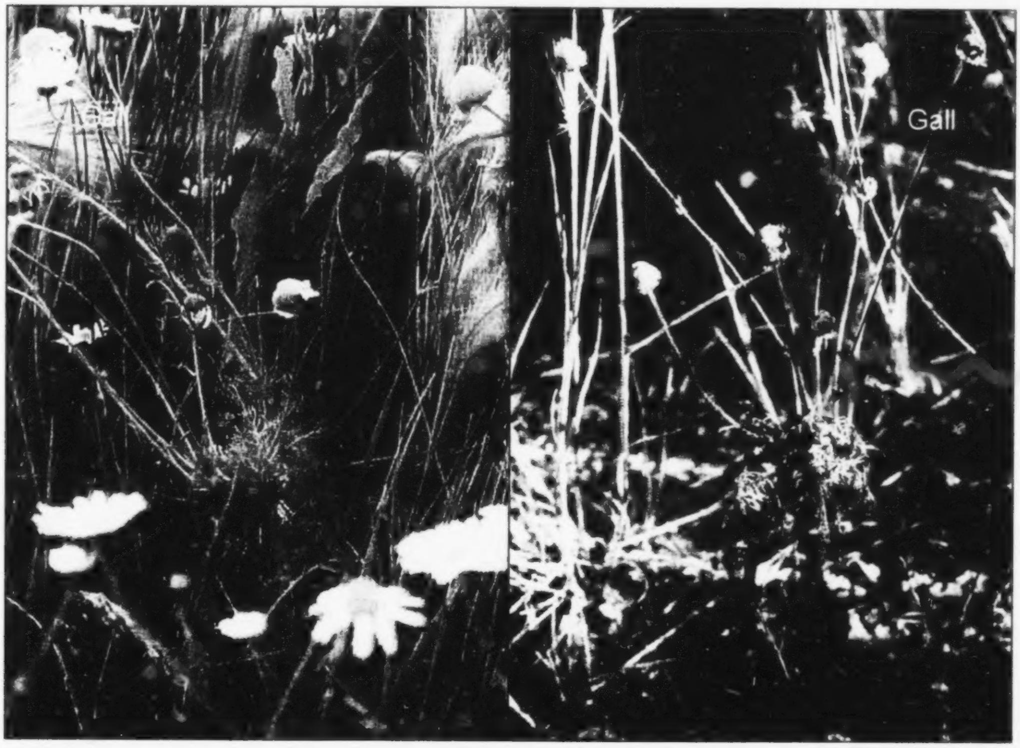


The gall midge over winters in galls that form in the fall on scentless chamomile rosettes. Figure 3 shows a gall on a scentless chamomile plant in the rosette stage.

In the spring, adult midges emerge from a gall and lay eggs on the growing points of scentless chamomile plants. The eggs hatch larvae which feed on the plant causing the formation of a new gall. It takes about 13 days from the exposure of a scentless chamomile plant to an egg-laying gall midge before a gall is visible. It takes about 35 days for a gall midge to complete a generation.

For Generation – 1, galls appear in late May to mid-June with adults emerging in early July. Figure 4 shows where to look for a gall on a scentless chamomile plant in June (left) and how visible these galls are in the fall (right). Most likely this is a Generation –

Figure 4. Galls on scentless chamomile plants as they appear in the spring (right) and fall (left)



1 gall and the adults left the gall in July.

For Generation – 2, galls appear in late July with adults emerging by late August to mid-September. In mid-September, galls appear on scentless chamomile rosettes, which form the Over-Winter Generation. Figure 3 shows a typical gall in the fall of the year.

Scentless Chamomile Life Cycle

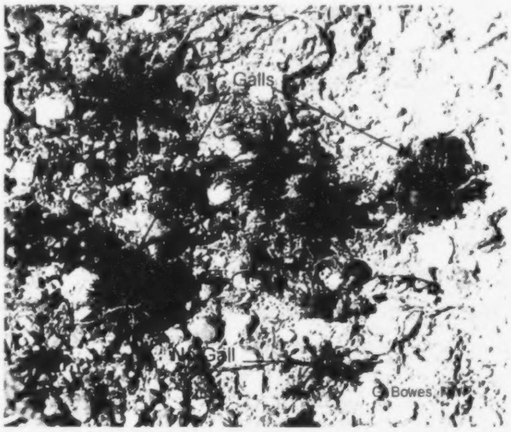
Seeds of scentless chamomile can germinate throughout the growing season. If a seed germinates before mid-July the plant is a summer annual and flowers during the growing season. If a seed germinates after mid-July, the plant is a winter annual. It grows a rosette and flowers next year. A few scentless chamomile plants will grow for more than one year and are classed as short-lived perennials.

In the spring, gall midges are more likely to attack a rapidly growing stem whereas in the fall midges attack a rosette.

Best Time to Collect and Release Gall Midges

Gall midges can be introduced into new sites by transplanting scentless chamomile plants with visible healthy looking galls. The best time to collect scentless chamomile plants with galls is in the early spring or late fall. The procedure for collecting gall midges in the spring and fall is similar. Spring is thought to be the best time to successfully transplant scentless chamomile plants but rosettes with galls are difficult to visually locate in the spring. Figure 5 show galls in the spring with reddish-brown and new green leaf growth. The gall in Figure 3 is a distinctive green growth which is typical of a fall gall after a killing frost. Scentless chamomile rosettes are frost tolerant.

Figure 5. Galls in late fall



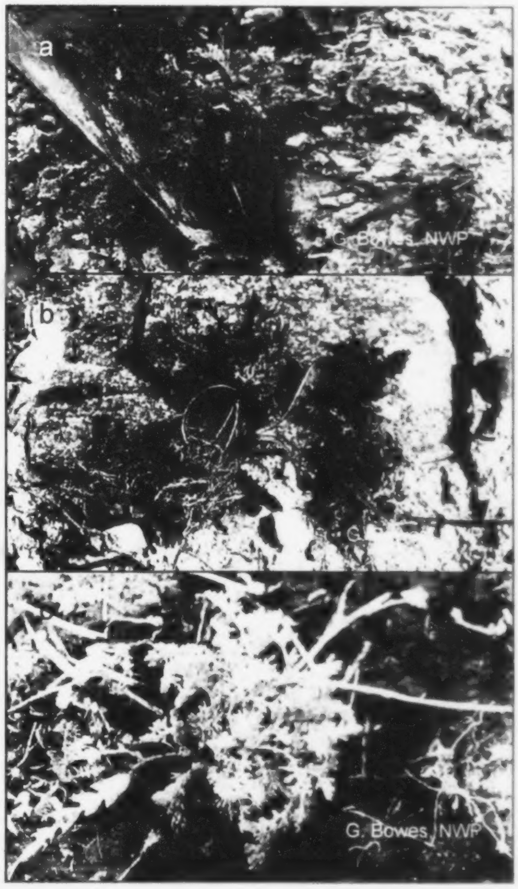
In Alberta, the success of transplanted scentless chamomile plants was 92% up to mid-July and 60% for releases made between mid-August to the early September. In an area with a dry fall and spring, the over winter survival of field scentless chamomile plants with galls was 48%. When vigorous greenhouse grown plants were transplants into a field, there was no over winter mortality. This suggests that it may be better to transplant vigorous galled scentless chamomile plants which are often found when fall and early spring moisture is above normal.

Conditions at Collection Time

In the spring, collect plants with galls after the soil has thawed but before growth starts. In the fall, collect galled plants after a killing frost but before freeze-up.

Check for galls by carefully pressing on the crown (the part of the plant between the leaves and root) of the plant with your thumb and forefinger. If you feel a solid swelling then this growth is most likely a gall. Sample a few scentless chamomile plants without galls to feel a slight swelling in the crown region. Photos of scentless chamomile plants with galls are shown in Figures 3 and 5.

Figure 6. a) Digging up a galled scentless chamomile rosette with a shovel, b) Galled scentless chamomile rosettes and c) transplanted galled plant



Collection Procedure

1. Locate a site where gall midges are known to have established from a list of locations that is available from the author

2. Phone the person responsible for the site for permission to enter the site and collect

3. Before going to the field to collect and release, obtain the necessary equipment
    - Shovel
    - Plastic lunch bags
    - Paper towels
    - Water container
    - Marker stake

4. Dig up 12 scentless chamomile plants that are growing with healthy looking galls on rosettes

5. Wrap the plants in paper towel, wet thoroughly, place the wrapped plants in a plastic bag for transport

6. Transplant these plants in a new area with scentless chamomile

7. Mark the release site with a stake and if possible use a GPS unit to obtain the position coordinates

Selecting a New Site for Gall Midge Release

1. Release gall midges at a site with a good stand of scentless chamomile that can be left undisturbed for 3 to 5 years

How to Release Gall Midges

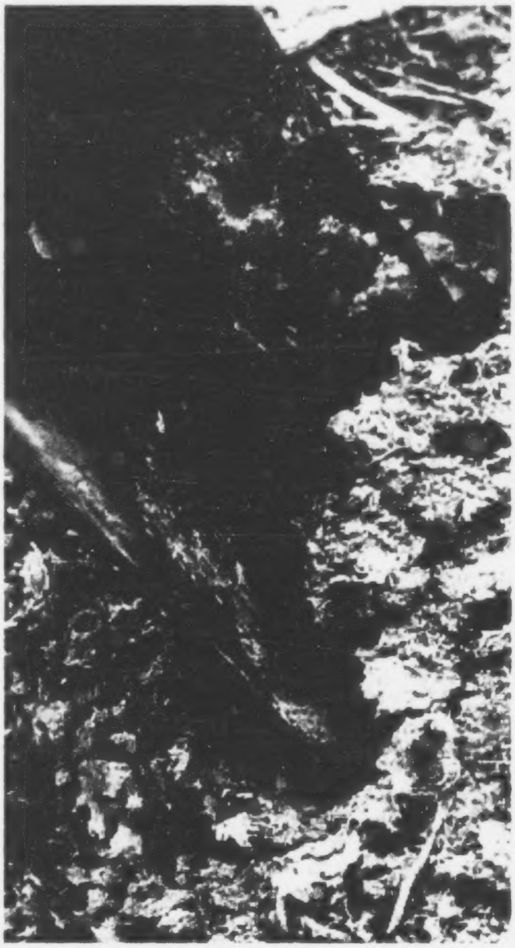
1. Force the shovel in to the soil and make a slit in the soil about 10 cm deep as shown in Figure 7

2. Put the galled scentless chamomile rosette in the slot, making sure the root is pointed down

3. Pack soil around the plant

4. Water when necessary

Figure 7. The slit in the soil that can be made by moving a shovel back and forth is often sufficient for transplanting a galled scentless chamomile plant



Evidence of Gall Midge Establishment

Look for the formation of galls on scentless chamomile stems in the spring and rosettes in the fall that are similar to the photos shown in Figures 3, 4, 5 and 6.

Scentless chamomile gall midges change the architecture of the plant. Plant height and flower number per plant can be reduced. Sometime more bolting but shorter stems are produced. Sometimes, plant weight and flower number are similar on galled and non-galled plants.

Prepared by Garry Bowes, Noxious Weed Program
Phone: 306 933-7695, e-mail: gbowes@agr.gov.sk.ca

2004 Saskatchewan U-Pick Leafy Spurge Flea Beetle Information Guide

Biological Control Agent Profile for Spurge Flea Beetles Page 3

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Canada

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Saskatchewan Agriculture, Food and Rural Revitalization

Dear Colleague

This report contains recent information on sites where biological control agents are established. Also, included is the method for collecting the agents.

The text for the method of collection is modified and reformatted from a previous publication, the Integrated Biocontrol Strategies for Noxious Weeds, Field Reference Manual by Brad Thompson. Photographs are not included in this report. Also, added was information from the web site of the Lethbridge Research Centre (http//res2.agr.ca/lethbridge).

The list of sites for beetle collection includes a contact person and a telephone number. **Please telephone the contact person for permission to collect biological control agents and the landowner for the right-to-enter private land.**

Please, do not trespass!

In the spring of 1999, the author attempted to telephone each contact person to find out if the release site is present and if there is any evidence of insect activity on leafy spurge. Since 1999, many of these sites have been monitored. This report contains the most up to date information on a release site.

Sites were assessed during July and August, on days that may not have yielded the highest number of beetles per sweep. Generally, the highest number of beetles per sweep are found on hot days (>30°) when the wind velocity is low. This is the best time for collection, which varies from year to year, starting during the last week of June into July in southern Saskatchewan. You will need to monitor a site frequently to find the best collection date.

If you have any comments on this report, please forward them to the author.

Best wishes,

Garry Bowes
Coordinator, Noxious Weed Program*
3830 Thatcher Avenue, Saskatoon, SK, S7K 3H6

Telephone: 933-7695
Facsimile: 933-7352
e-mail: gbowes@agr.gov.sk.ca

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* Financial support for The Noxious Weed Program has been provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada.

Biological Control Agents*

Biological control of leafy spurge is primarily by flea beetles which feed on the roots and leaves of the weed. The following insect profiles provide details on these insects, which show promise and/or have exhibited success in the control of leafy spurge in Saskatchewan.

Biological Control Agent Profile for Spurge Flea Beetles (*Aphthona* spp)

Description of the Brown Dot Spurge Flea Beetle (*A. cyparissiae*)

The adult flea beetle is approximately 2-3 mm long, dark brown in colored with an oval shape. Adults emerge in late June to early July to feed on the foliage of the leafy spurge plant. When the temperature is <10°C, adult movement is slow. The adults feed on the margins of the upper leaves and will actively jump or fly on warm sunny days. During this period, adults mate and the females will deposit eggs in the soil near the roots of the leafy spurge plant. Over the course of the summer, each female will lay an average of 285 eggs. The eggs hatch in approximately 17 days, and the larvae burrow through the soil in search of a first year root to feed on. As the larvae develop, they feed on the larger perennial roots. Larvae development requires about 165 degree-days above 10°C, which is about a 75-day feeding period. Root feeding stresses the leafy spurge plant because the larvae damaged the root system by consuming plant reserves. Feeding by the larvae continues throughout the summer and into early fall at which time the larvae construct an over wintering cell. Larvae must have at least 4 months at

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* This text is modified from the Integrated Biocontrol Strategies for Noxious Weeds, Field Reference Manual by Brad Thompson, available from Saskatchewan Agriculture, Food and Rural Revitalization. Photographs are not included.

<10°C to complete development. By mid-August the majority of the adult beetles have died. Feeding by larvae resumes in the spring for about 3 weeks after which the larvae pupate for 28 - 57 days. New adults emerge in late June and early July. There is one generation per year.

Impact of the Brown Dot Spurge Flea Beetle (*A. cyparissiae*)

The brown dot flea beetle can reduce the canopy cover of leafy spurge to <10% in a warm mesic sandy loam site. From the release point, the beetles attack in an expanding circle. Flowering leafy spurge plants are replaced by many small non-flowering stems, which are replaced by grasses and forbs.

Preferred Habitat for the Brown Dot Spurge Flea Beetle (*A. cyparissiae*)

The preferred habitat for the brown dot spurge flea beetle is:

- Flowering leafy spurge with an average height of **65 cm**
- Less than **80 flowering stems/m^2**
- A site with < 10% brush cover of the soil surface and < 25 cm tall
- The presence of green needle grass, *Stipa virdula*, growing with leafy spurge
- **Select sandy to sandy loam soils** with 60% sand and 15-25% clay
- Select moister sites in the short grass prairie than in the aspen parkland ecozone

Description of the Black Dot Spurge Flea Beetle (*A. nigriscutis*)

Similar to the brown dot spurge flea beetle, the adult black dot is 2-3 mm long and oval shaped. It also is predominantly bronze colored but with a tiny distinguishing black dot located immediately behind the head. The life cycle of the black dot flea beetle mirrors the life cycle of the brown dot with emergence in late June and early July.

One difference between the two species is the oviposition (egg-laying) period, which is shorter for the black dot flea beetle. Although this egg-laying period ends earlier, the total number of eggs laid is the same.

The habitat preference of the black dot flea beetle is the main difference between it and the brown dot spurge flea beetle. The black dot flea beetles prefer hot, open sites, which are drier than the areas preferred by the brown dot flea beetle.

Impact of the Black Dot Spurge Flea Beetle (*A. nigriscutis*)

The black dot spurge flea beetle can reduce the canopy cover of leafy spurge to <10% of the soil surface in warm open sites on dry coarse soils.

Preferred Habitat for the Black Dot Spurge Flea Beetle (*A. nigriscutis*)

Habitat characteristics that are most favourable for the black dot spurge flea beetle are:

- Leafy spurge flowering height of **60 cm or** less
- Less than 55 **flowering stems/m^2**
- A leafy spurge cover of 35% to 75% of the soil surface
- The cover of shrub and herb species should be **less than 5%** of the soil surface
- Preferred release sites are located in the warm, dry portion of the short grass prairie, the mixed grass prairie and aspen parkland ecozones
- The predominant grass species in uncultivated sites is spear grass, *Stipa comata*
- Locate release sites on **south-facing slopes, ridges, or knolls**

Description of the Black Spurge Flea Beetle (*A. lacertosa)*

There are two black flea beetles, *A. lacertosa* and *A. czwalinai*. *A. czwalinai* is more tapered at the front than the rear, whereas *A. lacertosa* is equally tapered.

As the name implies these beetles are black in colour and are 3 mm in length. Apart from this difference, their life cycle is similar to the other two species of beetle. However, there are differences in the development time and conditions during the life cycle. The eggs hatch in 17 days at 21°C. Larvae development requires 127 degree-days above 14°C or a minimum of 88 days at a constant 21°C. In the chamber, larvae hibernate for at least 4 months at <10°C. The black spurge flea beetles prefer environments that are moister than the habitats of other two species. The black spurge flea beetles also favours loam to clay-loam soil conditions.

Preferred Habitat of the Black Spurge Flea Beetles

- Unshaded and well watered loam and clay soils
- Will tolerate flooding for up to 3 months
- Will not survive on marshy sites

Matching *Aphthona* Beetles to the Leafy Spurge Infestation

Most sites will not exhibit all of the listed characteristics for any one species of spurge flea beetles, but those sites that more closely match the outlined habitat requirements will perform better.

> *The parameter, which is most important, is ground cover or the amount of light reaching the soil (leafy spurge height, leafy spurge density, and brush cover).*

Since the beetle larvae exert the greatest stress on leafy spurge roots, it is important for the sun to warm up the soil to stimulate the larvae to feed actively. This limitation renders the beetles ineffective in controlling leafy spurge when the brush cover exceeds *25%* or if leafy spurge density is too high. Additionally, sandy soil allows the larvae to move easily through the soil to access more roots.

How to Collect Spurge Flea Beetles for Release

Site Selection

Site assessment is the first step in the collection process. Potential release sites must be evaluated before beetle collection to ensure the proper species of beetles are collected. Select a site that is most similar to the preferred habitat for the brown dot, black dot or black spurge flea beetle. Release the most appropriate species for a site. Releasing a mixture of all three species, with the species in the highest percentage matching the release site, allows each species to thrive in micro sites.

Prepare for Collection

Many successful flea beetle sites are established throughout Saskatchewan. Table 1 lists locations where viable populations were monitored in 1994 – 1995 and 1999 - 2003. Between 1999 and 2003 new releases were made in Saskatchewan. Releases made in 2003 and monitoring data collected during 2003 are recorded in the 2004 report. Before collecting, one should call the appropriate contact person listed in Table 1 to ensure there is a viable population at a selected collection site. In addition, the contact person may be able to provide advice on the number of collections that can be made at the site. Call the landowner and request permission to access private property. According to research in the United States, spurge flea beetles cannot be over-collected from an established site. Most of these sites are on private property so **permission from the landowner to enter private must be obtained**.

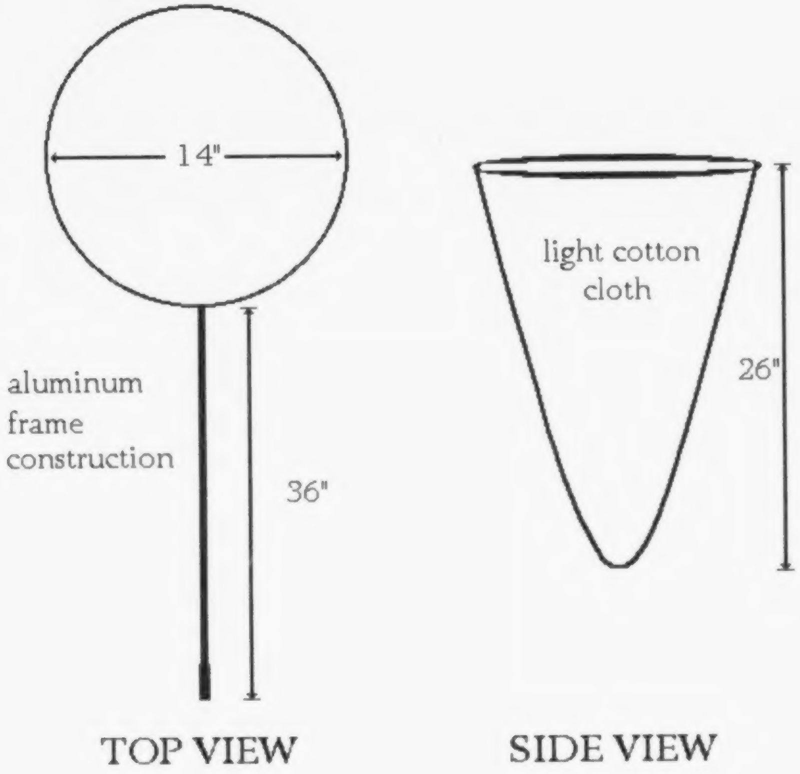
Collection Equipment

The equipment needed to collect the spurge flea beetle is as follows:

- Sweep net

- Collection containers
- Stapler
- Cooler with ice packs

Use a sweep net to capture spurge flea beetles. You will need to construct or purchase a sweep net. Figure 1 shows specifications for sweep nets used by Saskatchewan Agriculture, Food and Rural Revitalization.



• Figure 1 Standard specifications for a sweep net

If you choose to buy a sweep net, the fabricator that Saskatchewan Agriculture, Food and Rural Revitalization has used in the past is: PRO METAL Welding &

Machine Ltd., 555 Park Street, Regina, SK, S4N 5B2, phone 525-6710. The approximate cost for a unit is $40. Agriculture and Agri-Food Canada at Saskatoon use a sweep net purchased from: Ward's Natural Science Ltd., 397 Vansickle Road, St. Catharines, ON, L2S 3T5, phone 1-800-387-7822. The net used is called: Heavy Duty Sweep Net, catalogue number 10W 0560, costing $45.60 CND plus taxes. When ordering replacement bags use: Replacement Bags, catalogue number 10W 0565, costing $17.90 CND plus taxes. Another choice for a sweep net is: BioQuip Products, Inc., 2321 Gladwick Street, Rancho Dominguez, CA 90220, phone: (310) 667-8800, fax: (310) 667-8808, e-mail: info@bioquip.com. Prices in BioEquip's catalogue are in US dollars.

Time of Year to Collect Spurge Flea Beetles

The timing of collection is important in order to maximize the number of beetles collected. High beetle numbers feeding on leafy spurge often occur during hot days (>30ºC) with light winds. Collections are most productive in late June and early July as soon as the adults have emerged. Adults are active but have not laid many eggs. It is best to collect beetles at this time in order to maximize egg laying at the new site. This window of opportunity is approximately 3 weeks from late to the end of July; collections after this time will likely fail, as an insufficient number of eggs will be laid to create a viable population for the following year.

There is no guarantee that sufficient numbers still exist to support a collection at the sites listed in Table 1. It is recommended that before collections are attempted, one should phone the listed contact person in the area to ensure that there is a viable beetle population.

Weather at the Time of Spurge Flea Beetle Collection

Weather conditions are important for a successful beetle collection. The ideal day is a sunny hot day (>30ºC) with little wind. These conditions are conducive to the adults feeding on the upper canopy of the leafy spurge infestation. When the weather is cool, wet, and/or windy, the beetles are not very active and tend to stay closer to ground.

Method for Collecting Spurge Flea Beetles

To start a collection, move directly to the release point at the collection site; ideally, a stake should be present to mark the release point. If a stake is not present, there should be sufficient beetle damage to determine the area where the beetles were released. Leafy spurge density will be low and will gradually increase with distance away from the release site, creating a "halo-effect" around the point of release. At well-established sites, beetle spread will be extensive and this gradation may not be quite as apparent.

To begin collections take one or two sweeps of the leafy spurge plants around the initial release site and count the number of beetles caught. This provides an estimation of the number of beetles captured per sweep in the area. When sweeping, sweep only the top 6-8 inches of the plant to collect the beetles. The motion of the net should be a quick sweeping motion, side to side in the direction of movement. Try to be quick with the net, but without shearing the plant tops.

Once the average number of beetles per sweep has been determined, collection of the beetles for the releases can begin. Try to collect at least 1000 to start a new colony. Dr. Rob Boucher, AAFC in Lethbridge, AB releases 2000 on good sites and 4000 on poor sites. In the United States, TEAM leafy Spurge liked to release 6000 per site. The number of releases that are collected depends on the number of proposed release sites and the number of beetles present at the collection site. More than one release can be made in a large leafy spurge infestation. However, if there are many proposed releases it is better to make one release in each site to ensure a population establishes in one area of a site to allow for subsequent re-distribution. Experience has also shown that sweeping in areas that are not heavily infested with leafy spurge plants can yield a high number of beetles. If a stand is difficult to walk through or sweep in, it probably does not contain many beetles.

> *Try to avoid extraneous movement in the collection area because when disturbed the beetles will jump off the plants and fall to the ground.*

When the beetles are in the net, the next step is to transfer them into one of the collection containers. First, remove some but not all of the vegetation from inside the sweep net. Leaving a little leafy spurge material with the beetles is a good idea if they are going to be stored. Next, gently shake the net so all the beetles fall to the bottom. The beetles will try to crawl and hop out so do not leave the net unattended for too long. When the beetles are at the bottom of the net, pinch it off into a pocket so they cannot climb out. Gently empty this little pocket of beetles into the collection container (either a milk carton or paper bag), and when all the beetles are out of the net, seal the container using a stapler. **Make sure the container is thoroughly sealed,** or more beetles may be crawling on the outside than the inside of a container! Once the beetles are safely sealed away, put them in a cooler. If the beetle release is almost immediate after collection and the vehicle they are being transported in is air-conditioned, they should survive transport. Repeat this process to obtain the number of releases desired.

Establishing a Release Site

Selecting the Release Point

Select the exact location for a release several weeks before collection day. Because there are only a few hot, low wind days in Saskatchewan, you will want to spend most of your time collecting beetles during ideal weather conditions.

There are a few conditions to bear in mind when selecting a release site. The leafy spurge density should be within the appropriate parameters listed in the habitat preference section. A common misconception has been to put the beetles in where the leafy spurge is thickest. Unfortunately, when the females lay their eggs, the canopy will shade the ground inhibiting the development of the beetle larvae.

> *Choose a spot where the leafy spurge is somewhat thinner, usually near the perimeter of the stand.*

This will allow the beetles to spread naturally into the thicker leafy spurge with greater success. In terms of geography, **a good release site is one with a south-facing slope**. Since the larvae are root feeders, it is important for the soil to warm up in order that the larvae become active and feed on the roots. Moreover, slopes are good release sites because they are also well drained; a release site should not be located in a depression because standing water can drown the larvae.

As mentioned in the Introduction, predators also pose a threat to a new beetle release. Insects such as ants and wasps will feed on the beetles. **Do not release the beetles near an ant hill or wasp nest.** Placing a release close to an ant hill or wasp nest will only serve to provide those insects with a temporary change in diet.

Equipment Needed

If the proposed sites have sufficiently met the criteria for the species of beetles being released, mark the sites for future beetle release. The equipment recommended for this is:

- Stake (4-6 feet in length)
- Sledge hammer
- Camera
- Pen and paper
- ¼ m^2 quadrat

How to Release Spurge Flea Beetles

After the preliminary work is done, release the beetles. Begin by opening the transport container. Lay it on the ground on its side close the release point. The container does not have to be exactly where the stake is, within 1 meter is acceptable.

> *With the container open, the beetles can move out of the container on their own and acclimate themselves to the new environment.*

This is particularly important if the beetles have been stored at cool temperatures for any length of time. Simply dumping them out of the container creates an additional stress, which will increase mortality. During the 10-15 minutes that the beetles need to "warm up" it is advisable to complete a release data sheet. After 10-15 minutes, pickup the container and gently shake out the remaining beetles. Put all of the beetles in one spot. When all the beetles are out, take a photograph of the site. Pictures should include the stake and give a clear visual picture of the leafy spurge infestation.

A copy of the release form used by Saskatchewan Agriculture, Food and Rural Revitalization is included with this document. If you need additional copies of the release form, then print or photocopy the form in this report. The requested information allows for the site characteristics to be compiled and used to properly evaluate the success of the biological control agents. Most of the information requirements are self-explanatory; however a brief discussion of a few points will serve too high light their importance. The approximate age of the leafy spurge stand is significant when trying to correlate the time required for the beetle to provide adequate control of the weed. Older leafy spurge stands have a more extensive the root system. Consequently, shoot reduction by any of the spurge flea beetles in a stand that is 20 years old will take much longer than a stand that is 5 years old. Larvae eat small roots that were the recently produced by the weed.

Information pertaining to the density and height of the flowering and non-flowering shoots is required to establish a baseline reference point when the beetles are released. Early signs of beetle damage include an increase in the number of non-flowering stems and a reduction in the number of flowering stems.

The easiest way to determine the number of stems in a square meter is to fabricate a small quadrat 0.5 x 0.5 meters in size. You can use rebar or wood to construct a quadrat. Randomly place a quadrat in a leafy spurge stand and then count leafy spurge stems within the quadrat. This provides the number of stems per quarter square meter, so multiplying this quantity by 4 will determine the number of stems per square meter.

Record percent cover, site topography, and weather conditions for the site. These are characteristics, which affect the probability of a successful release. Information on topography may indicate the prevalence of standing water at the site.

Temperature at the time of release may help explain why a site failed, when all the site requirements appeared optimal. For example, on a cool day, recently released beetles will not be active and are not fully camouflaged by the ground cover. This can lead to higher predation from other insects to the point that establishment could not occur.

Although some of these cause-and-effect relationships may not seem intuitively obvious, possessing a complete set of data will allow proper evaluation and provide possible explanations for the success or failure of beetle establishment.

Assessment of Beetle Establishment: Annual Site Evaluation

Monitoring a Spurge Flea Beetle Release Site

Beetle release sites should be monitored on a regular basis in order to assess the relative health of beetle populations. The optimal time for monitoring the success of beetle establishment is the last week of June to the third week of July. Weather should be warm and sunny, to ensure beetles are active on the upper portion of the plants.

Monitoring Equipment

The equipment needed to perform the yearly follow-up includes:

- Sweep net
- Pen and data sheet
- Camera
- Hammer and stake
- $^1/_4$ m^2 quadrat

As mentioned previously, the hammer and stake are optional but very handy for replacing the original stake if it has been broken or vandalized.

Method to Monitor Spurge Flea Beetle Establishment

To begin the annual assessment, move directly towards the release stake with the equipment. Observe the plants along the path to see if beetles are actively feeding on the foliage or if the shoots exhibit any beetle damage. Within two metres of the release stake, make one or two sweeps of the leafy spurge plants. Check for the presence of beetles in the net and determine the number collected. Empty the net in the location you have swept and repeat the procedure at different locations around the stake. When a consistent number of beetles are obtained on each sweep, begin to move away from the stake to determine the radius of spread. Although this spread is commonly circular, the beetles may move in one direction to an area of leafy spurge that is more favourable. Once the number of beetles per sweep adjacent to the release stake and the distance of spread have been recorded on the data sheet, record the density and height of flowering leafy spurge shoots inside and outside the beetle feeding area. Finally record any comments that may be pertinent to the beetle population (spring snow, insecticide drift) or leafy spurge stand (herbicide drift, mowing). In the event the data obtained that year are not consistent with data collected in previous seasons; comparable pictures of a site on a yearly basis are an excellent way to track and record progress at a site. To maximize the effectiveness of the photographs, always photograph from the same location, with the same perspective as the previous years' photographs. Use the data sheet provided as an outline of the type of information that is important to collect. The data collected is very similar to that recorded at the release except measurements are recorded inside and outside the established beetle area.

Evidence of Spurge Flea Beetle Damage on Leafy Spurge

Signs of beetle damage are "shot-holes" in the leafy spurge leaves from adult feeding and a reduction in the number of flowering stems. An increase in the proportion of new nonflowering leafy spurge shoots to flowering shoot is typical of flea beetle larvae damage in the first few years after release. As beetle establishment continues, the beetles will then reduce the number of non-flowering shoots. This will create a halo around the release point where few or no leafy spurge shoots remain.

A greater proportion of non-flowering shoots is a direct consequence of larval damage to the root system. The plant develops more shoots to offset the loss of buds and root reserves in the plant. Therefore, the increase in non-flowering shoots around the release site indicates the presence of larval damage. This effect may persist for up to four years. Other signs the beetle has successfully established in an area are:

- capturing *25* beetles or more with 5 sweeps the year subsequent to release;
- the presence of beetles 5 meters away from the initial release point one year after release;
- an increase in the number of non-flowering leafy spurge stems (which may persist up to four years) surrounding the release stake; and
- a reduction in the number of flowering stems after two or three years.

When to Harvest a Release Site for Redistribution

Beetle releases that exhibit excellent establishment are generally ready for harvest three full years after the initial release. Harvest sites when a sweep averages 15 or more beetles in the net. If the average is at or above this number, then the site can comfortably support beetle collection; below this, harvest is risky. Other factors to consider when deciding whether or not harvesting is appropriate include: weather conditions at the time of monitoring; age of the release; spread of the release; and knowledge of previous collections on the site.

Spurge Flea Beetle (*Aphthona* spp.) Release Form

Date: ______________________

Number of beetles released: ________

Release location: ______________

Agent released: ________________

Release code: __________________

Nearest town: __________________

Directions to release site (including legal location): ________________________

Enter Section in one of the squares below Range ___

Tp ___

Released by:

Name: ______________________

Address: ____________________

City: _______________________

Province: ___________________

Postal code: ________________

Phone: _____________________

Landowner (if different from release person)

Name: ______________________

Address: ____________________

City: _______________________

Province: ___________________

Postal code: ________________

Phone: _____________________

(Please proceed to the next page)

Site Characteristics

Infestation: _______ Continuous _______ Patchy

Extent: _______ <2.5 ha (<6 acres) _______ 2.5 – 10 ha (6 – 25 acres) _______ >10 ha (>25 acres)

Approximate age of spurge stand: ____________

Stems per square meter: ___________ % of stems flowering: ___________

Average height of flowering stems: ___________ Non-flowering stems: ___________

% Cover (all vegetation except spurge): ___________

Site topography: _____ Level _____ Slight slope _____ Steep slope

Temperature (day of release): ______ °C

Weather conditions (day of release): ________________________________
(Sunny, windy, etc.)

Land Use

Current use: ______ pasture ______ right-of-way ______ parkland

______ other, if so describe: ______________________

ANY herbicides applied within 2 yr.? ______ Yes ______ No

If yes, type and rate: ______________________________

ANY herbicides applied within 2 yr.? ______ Yes ______ No

If yes, type and rate: ______________________________

Miscellaneous Information: (comments concerning adverse weather or agronomic conditions that could influence either insect numbers (i.e. pesticide drift) or weed stands)

____

____

____

____

PLEASE REMEMBER TO STAKE THE SITE

Please make a copy of this release form and forward it to:

Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK S7K 2H6
Phone: 933-7695, Fax: 933-7352, e-mail: gbowes@agr.gov.sk.ca

Spurge Flea Beetle (*Apthona* spp.) Monitoring Report

Site Data

Release Number: ____________________ Agent: ____________________

Assessment person: ____________________ Date: ____________________

Contact phone number: ____________________ Legal location: ____________________

Sample Data

Time: ____________________ Temperature: ____________________

Weather conditions at time of sampling: ____________________

Inside Beetle Area		Outside Beetle Area	
Number of flowering plants /m^2:	________	Number of flowering plants /m^2:	________
Height of flowering plants:	________	Height of flowering plants:	________
% Cover		% Cover	
Leafy spurge:	________	Leafy spurge:	________
Grasses & Forbs:	________	Grasses & Forbs:	________
Bare ground:	________	Bare ground:	________

Insect Density Estimate

Number of beetles per sweep: ____________________

Maximum distance of spread: ____________________

Feeding damage observed: ____________________

Herbicide Use

Any herbicide applied within the last year? ______ Yes ______ No

If yes, please indicate the 1) type 2) rate 3) timing: ____________________

Miscellaneous Information

(Comments concerning adverse weather or agronomic conditions that could influence either insect number (i.e. pesticide drift) or the weed stand)

Please make a copy of this release form and forward it to:

Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK S7K 2H6
Phone: 933-7695, Fax: 933-7352, e-mail: gbowes@agr.gov.sk.ca

Table 1. List of Sites for Collecting Spurge Flea Beetles

RM 1 Argyle SW 7-2-31 W1 SK-N-90-0045	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in1995	**3 to 4**	10 x 20	60	55	85.6	5.2	
Monitored in 2000	**0**						
Black Dot Beetle Release in 1990.				N 49.10379		W 101.62551	

Comments: In 1997, lots of beetles on site. Sunny, warm and light wind when monitored in 2000. Site is not grazed and has a thick litter layer. Site died out. GPS1 WP28.

Contact Person: Val Olney 685-2010

RM 1 Argyle SW 7-2-31 W1 RM Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1993	**2**	9 x 5	80	40			40
Monitored in 2000	**1**						
Brown Dot Beetle Release in 1992 from Maxim.				N 49.10379		W 101.62551	

Comments: In 1997, lots of beetles on site. Sunny, warm and light wind when monitored in 2000. Lots of beetles in 1999 Site has not been grazed for years and has a thick litter layer. GPS1 WP28.

Contact Person: Val Olney 685-2010

RM 2 Mount Pleasant SW 3-3-32 W1 SK-C-90-0002	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**7 to 10**	10 x 30	75	55	74.6	7.7	
Monitored in 2000	**5 to 8**						
Brown Dot Beetle Release in 1990.				N 49.18410		W 101.72844	

Comments: 1999: Phone survey. In 1997 lots of beetles, leafy spurge is reduced. Sunny with some clouds when monitored in 2000. In 1999, lots of beetles. Beetles found in areas with little litter on a south facing slope. Some leafy spurge thinning. Site has not been grazed for several years. GPS1 WP024.

Contact Person: Brian Miller 482-3313

RM 2 Mount Pleasant SW 3-3-32 W1 Farmer Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1993	**3**	10	48	35			10
Monitored in 2000	**0 - 1**						
Brown Dot Beetle Release From Maxim in 1992.				N 49.18410		W 101.72844	

Comments: In 1997 lots of beetles, leafy spurge is reduced. Sunny with some cloud when monitored in 2000. The site is north of a ridge into a valley and has lots of litter. No evidence of leafy spurge damage. GPS1 WP024.

Contact Person: Brian Miller 482-3313

RM 4 Coalfields NE 5-2-4 W2 SN-96-003	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in							

Brown Dot released in 1996. N 49.0983 W 102.4954

Comments: Nearest City: North Portal.

Contact Person: Stephanie Schnell 634-7959; Landowner: Walter Lee 927-2235

RM 5 Estevan SW 14-1-7 W2 SK-C-92-0009	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**15**	30 x 50	45	35			
Monitored in 2000	**5 to 8**		2 to 5				
Monitored in 2002	**1 to 2**		0				

Brown Dot Beetle Release in 1992. N 49.03169 W 102.85227

Comments: 1995: Influence of beetles has spread out further this year continuing down the hill. Collections can be made in 1996. 1999: Phone survey. Good site in 1998, now a buffalo pasture (Lorne John). Sunny and hot when monitored in 2000. Higher numbers at the edge of the control circle. Good control down the hill. 2002: Release area. Photo 2002 P9 - 014, 015, 016. 15 - 20/sweep at the edge of leafy spurge (P9 - 15). GPS1 WP035.

Contact Person: Landowner Unknown

RM 5 Estevan NW 2-1-7 W2 SK-N-89-0009	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10 to 15**	50 x 50	55	45	90.9	3.5	
Monitored in 2000	**1 to 2**	2 - 5 ac					
Monitored in 2002	**10**		>1				

Black and/or Brown Dot Beetle Release in 1989. N 49.00718 W 102.84924

Comments: 1995: Site has improved, beetles have increased & spurge density has decreased. Collections can be made in 1996. 1999: Phone survey. Very good site in 1998. When monitored in 2000, the beetles had spread over a large area. The leafy spurge stand was reduced/thinned. The edge of the spread of the beetles was not apparent. 2002: Release sites. Photo 2002 P9 - 012, 013. Mostly Black with some Black Dot. GPS1 WP032.

Contact Person: Don Seipp 634-4414, 421-0428 (cell)

RM 5 Estevan SE 3-1-7 W2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**5 to 10**	50 x 50	<1				
Monitored in 2002	**1**		<1				

Black Beetle Release in 1998. N 49.00697 W 102.84720

Comments: 2000: Sunny and hot when monitored. Beetles moved up the hill, 300 m. 2002: Release site, close up, area. Photo 2002 P9 - 009, 010, 011. Good control. GPS1 WP031.

Contact Person: Don Seipp 634-4414, 421-0428 (cell)

RM 5 Estevan SW 28-1-7 W2 Luscar1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**2**		5				

??? released on ??? N 49.05862 W 102.88057

Comments: 2002: Release area. Photo 2002 P9 - 005. Black Dot. Luscar Coal site. GPS1 WP218.

Contact Person: Allan Klesse 636-5256

RM 5 Estevan SW 28-1-7 W2 Luscar2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**3 to 5**		2				

??? released on ??? N 49.05886 W 102.87938

Comments: 2002: Release area and close up. Photo 2002 P9 - 006, 007. Black Dot. Luscar Coal site. GPS1 WP219.

Contact Person: Allan Klesse 636-5256

RM 5 Estevan SE 22-1 -8 W2 Seipp1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**30**		10				

Black Beetles released on July 2000. N 49.04809 W 102.99012

Comments: 2002: Release site. Photo 2002 P9 - 008. New site. GPS1 WP220.

Contact Person: Don Seipp 634-4414, 421-0428 (cell)

RM 5 Estevan NE 8-1-8 W2 Seipp2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**15 to 25**		10				

??? released on ??? N 49.02329 W 103.02457

Comments: 2002: Release site, area by water, area. Photo 2002 P9 - 017, 018, 019. In mid-October 2001, a wild fire burned the released area. 80% Black Dot and 20% Black. GPS1 WP222.

Contact Person: Don Seipp 634-4414, 421-0428 (cell)

RM 5 Estevan NE 8-1-8 W2 Seipp3	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**25**		10				

??? released on ??? N 49.02277 W 103.02462

Comments: 2002: Release area (2). Photo 2002 P9 - 020, 021. 25/sweep Black Dot and a few Black. GPS1 WP221.

Contact Person: Don Seipp 634-4414, 421-0428 (cell)

RM 36 Cymri NE 36-6-13 W2 SK-N-90-0048	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**15 to 20**	20 x 30	25	35	61.4	17.1	

Black Dot Beetle Release in 1990. N 49.5203 W 103.6202

Comments: 1995: Beetle numbers have recovered and they've moved down into the coulee. 1999: Phone survey. Good site in 1998, moved one-half mile.

Contact Person: Merlin Becker 456-2562

RM 38 Laurier NE 1-4-16 W2 Maxim	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**35**	unlimited	varies	varies			
Monitored in 1999	**5**	18	7	58			
Monitored in 2001	**5**	5	30				

Brown Dot Beetle Release in 1982. Also, black dot and black N 49.27943 W 104.03433

Comments: 1995: Approximately 11,000 beetles removed from site in 1995. 1999: Phone survey. In 1998 beetles were plentiful, beetles are reducing leafy spurge. 1999: Mixture of three species. 2001: Mostly Br Dot with some Black Beetles. The beetles thinned leafy spurge but some leafy spurge set seed. GPS1 WP021.

Contact Person: Landowner Unknown

RM 42 Willow Bunch SE 23-6-28 W2 SN-96-001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in							

Black Dot released in 1996. N 49.4839 W 105.6609

Comments: Nearest City: Verwood.

Contact Person: M. Brown 473-2302; Landowner: 473-2777

RM 42 Willow Bunch SE 25-6-28 W2 SN-96-002	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in							

Black Dot released in 1996. N 49.4985 W 105.6385

Comments: Nearest City: Verwood.

Contact Person: M. Brown 473-2302, Landowner: Glenn Berner 642-5760

RM 43 Old Post NE 19-4-2 W3 Springer US5	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	3		10				

6,000 black beetles released on June 22, 2001. N 49.31820 W 106.24823

Comments: 2001: SE of Wood Mountain on 705, then south. Adjacent land was broke hayland in 2001. Site marked with metal T-posts. 2002: Release site. Photo 2002 P6 - 024, 025. Mostly Black Dot, some Black established. Found 10 hawk moths. Lots of ants at release site. GPS1 WP213.

Contact Person: Bob Springer 778-8301; Landowner: Judy Mergel 266-4211

RM 45 Mankota SE 15-6-7 W3 Stanger Rel 1997-98	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	0						
Monitored in 2002	<1		10				
Monitored in 2003	1 to 3		6	69			

Black Dot or Brown Dot Beetles released in 1996-97. N 49.46556 W 106.85305

Comments: Nearest town; McCord. Cloudy, nearly raining when monitored in 2000. Plan to use 2,4-D at 24oz/ac + dicamba at 4 oz/ac, applied annually to control leafy spurge. Found 1 Black that had moved from the adjacent location. 2002: Release area (2), dam. Photo 2002 P10 - 001, 002, 003. Sampled patches on the east side. 2003: Black. Area treated with a herbicides, beetles are on the missed herbicide treated plants. Site photo. 2003 P10 - 001. GPS1 WP009.

Contact Person: Landowner: Calvin Govelin 478-2533

RM 45 Mankota NW 11-6-7 W3 Lennox Rel 1998	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	6 to 7						
Monitored in 2003	1		1	25			

Black Beetle released in 1998. N 49.46531 W 106.85339

Comments: Nearest town; McCord. Cloudy, nearly raining when monitored in 2000. Plan to use 2,4-D @ 24oz/ac + dicamba at 4 oz/ac, applied annually to control leafy spurge. 2003: Site photo. 2003 P10 - 002. GPS1 WP010.

Contact Person: Landowner: Calvin Govelin 478-2533

RM 45 Mankota NW 11-6-7 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2003	1		1	25			

Released date unknown. N 49.46556 W 106.85305

Comments: 2003: Black. Site photos. 2003 P10 - 003, 004 (satellites around edge). GPS1 WP011.

Contact Person:

RM 45 Mankota NW 1-1-8 W3 Sherven1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	2		15				

??? released on ??? N 49.01201 W 106.95169
Comments: 2002: Release area (2). Photo 2002 P9 - 023. Black Dot. GPS2 WP349.
Contact Person: Mike Sherven 478-2323

RM 45 Mankota NW 1-1-8 W3 Sherven2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	2		0				

??? released on ??? N 49.01024 W 106.95690

Comments: 2002: Release area, close up. Photo 2002 P9 - 024, 025. Sampled on the side of the hill, treated with Tordon 22K in 2001. On a warm day in the first week of July the site had up to 100/sweep. GPS2 WP350.

Contact Person: Mike Sherven 478-2323

RM 49 White Valley SW 36-7-22 W3 SK-N-88-0013	No. of Beetles / Sweep	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	5 to 8		6	30			
Monitored in 2001	2						

1988 Black Dot Beetle Release, 1990-91 Brown Dot release. N 49.59934 W 108.86701
Comments: 2000: Sunny, with some cloud, cool, little wind when monitored. Beetles cover 5 - 8 ac. 2001: A lot of leafy spurge with vegetative shoots. GPS1 WP150.
Contact Person: Louis Debbit 295-3553; Landowner: Peter Hanson 295-4078

RM 49 White Valley SW 36-7-22 W3 SK-N-90-0057	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	5 to 15	unlimited	50	45	82.6	10.7	

Black Dot Beetle Release in 1990. N 49.6001 W 108.8627

Comments: 1995: Beetle success has improved in this area. Insect damage is beginning to show around the release point. Site not visited since 1995. 2001: Appears to be the same site as SK-N-88-0013. Site not found.
Contact Person: Peter Hanson 295-4078

RM 49 White Valley SW 36-7-22 W3 SK-C-91-0019	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**15 to 20**	unlimited	60	40	76.4	11.4	
Monitored in 2001	**5**		10	40			

Brown Dot Beetle Release in 1991. N 49.59889 W 108.86879

Comments: 1995: Site is doing well with high beetle numbers. Damage to the spurge is limited though due to the high density of the weed. Site may have merged with 1990 black dot site. Site not visited since 1995. 2001: Lots of plants with vegetative shoots and a few with seed heads. GPS1 WP151.

Contact Person: Louis Debbit 295-3553; Landowner: Peter Hanson 295-4078

RM 49 White Valley SE 5-8-22 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**>1**						

Black Beetle released in 1998. N 49.6147 W 108.9418

Comments: Nearest town; Eastend. 2001: Site is located near bush, the beetle do not appear to be effective.

Contact Person: Landowner: Raymond White 295-4079

RM 49 White Valley SE 5-8-22 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**>1**		10	40			

Brown Dot Beetle released in ? N 49.61697 W 108.88155

Comments: Nearest town; Eastend.2001: Leafy spurge is thinned out, some seed heads are present. GPS1 WP152.

Contact Person: Landowner: Raymond White 295-4079

RM 49 White Valley SE 5-8-22 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**N=2 S=4**	N=40 S=30	N=30 S=30				

Brown Dot Beetle released in ?

North	N 49.62426	W 108.85671
South	N 49.62418	W 108.85711

Comments: Nearest town; Eastend. Some leafy spurge thinning and some vegetative shoots. GPS1 WP153 and WP154.

Contact Person: Landowner: Raymond White 295-4079

RM 49 White Valley NW 10-5-19 W3 98 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**N=12 S=8**		N=10 S=20	N=41 S=38			

Black Beetle released in 1998.	North	N 49.37254	W 108.48488
	South	N 49.37227	W 108.48632

Comments: Nearest town; Shaunavon. Site is difficult to access. 2001: North; Leafy spurge is thinned out but some set seed. South; Some reduction in leafy spurge density. GPS1 WP148 and WP149.
Contact Person: Trevor Lenox 297-5450; Landowner: Daryl Allemand 296-4712

RM 63 Name SE 16-7-2 W2 McLean Rel 1998	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	1	0	20				

Black Beetle released in 1998. N 49.55669 W 102.21348
Comments: Nearest town; Carlyle. Released at 2 locations, 2 posts, SE has ants and few black beetles, NW post, 1/sweep, near post with leafy spurge (few ants). GPS1 WP039.
Contact Person: Landowner: Don Bax 453-6046

RM 64 Brock NW 16-8-6 W2 SK-N-90-0046	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	50 x 30	20	40	79.1	8.8	10

Black Dot Beetle Release in 1990. N 49.6511 W 102.7622
Comments: 1995: Site doing well. Some collections made. Relocated some beetles within site. Good site in the past. 1999: Phone survey. Lots of beetles in 1997, leafy spurge stand reduced.
Contact Person: Bruce Waddel 462-2010

RM 69 Norton NE 11-12-20 W2 Douslin - 1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

Black and Brown Dot released in 2000. N 49.9857 W 104.6218
Comments: 3500 released on wildlife land July 30.
Contact Person: Rocky Coleman 787-1040 SE

RM 69 Norton NE 11-12-20 W2 Douslin - 2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

Black and Brown Dot released in 2000. N 49.9857 W 104.6218
Comments: 2500 released on wildlife land July 30.
Contact Person: Rocky Coleman 787-1040 SE

RM 74 Wood River NE 9-7-6 W3 Springer US1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**5 to 20**		5				
Monitored in 2003	**1 to 3**		4	51			

10,000 black beetles released on June 22, 2001. N 49.54374 W 106.75469

Comments: 2001: ~ 11 miles south of Woodrow on 610 at bridge crossing Wood River, north side of the river. Adjacent land is farmed - fallow in 2001, site is marked with 4 ft x 1/2 inch PVC pipe. 2002: Release site. Photo 2002 P6 - 020. Rusk1. 50% Black and 50% Black Dot established. 5/sweep near the river. Black Beetles on the river side of the stake. 2003: Black 100%. Circle around stake. 1/sw near stake, 3/sw in foreground. 2003 P9 - 022, 023. GPS1 WP210.

Contact Person: Bob Springer 778-8301; Landowner: Cliff Rusk 472-5692

RM 74 Wood River SE 9-7-6 W3 Springer US2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**12**		4				
Monitored in 2003	**1 to 3**		1	33			

10,000 black beetles released on June 22, 2001. N 49.54497 W 106.75577

Comments: 2001: ~ 11 miles south of Woodrow on 610 at bridge crossing Wood River, west side of the river. Adjacent land is farmed - fallow in 2001, site is marked with 4 ft x 1/2 inch PVC pipe. 2002: Release site. Photo 2002 P6 - 021. Rusk2. Black established. 2003: Black, a few Black Dot. Site photos. 2003 P9 - 024, 025. GPS1 WP211.

Contact Person: Bob Springer 778-8301; Landowner: Cliff Rusk 472-5692

RM 74 Wood River SE 9-7-6 W3 Red and White Stake	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**4**		10				
Monitored in 2003	**1 to 3**		15	23			

Unknown release. N 49.54232 W 106.75396

Comments: 2002: Release site. Photo 2002 P6 - 022, 023. Black established. Site by an unknown red and white marker stake. 2003: 1/sw upland, 3/sw in river flat. Black 100%. Site photos 2003 P9 - 019, 020. GPS1 WP212.

Contact Person: Bob Springer 778-8301

RM 74 Wood River SE 9-7-6 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2003	**2**		25	48			

Released date unknown. N 49.54549 W 106.74925

Comments: 2003: Black Dot. Site photo. 2003 P9 - 018. GPS1 WP159.

Contact Person:

RM 74 Wood River NW 10-7-6 W3 Springer US3	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		8				

14,000 black beetles released on June 22, 2001. N 49.54529
Comments: 2001: ~ 11 miles south of Woodrow on 610 at bridge crossing Wood River, north side of the river. Adjacent land is farmed - fallow in 2001, site is marked with 4 ft x 1/2 inch PVC pipe. 2002: Release site. Photo 2002 P6 - 017. Black and Black Dot established. Filson #1. GPS1 WP160.
Contact Person: Bob Springer 778-8301; Landowner: Ben, Dwayne and David Filson 472-5914

RM 74 Wood River NW 10-7-6 W3 Springer US4	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**10**		15				
Monitored in 2003	**1**		10	74			

10,000 black beetles released on June 22, 2001. N 49.54522 W 106.74736
Comments: 2001: ~ 11 miles south of Woodrow on 610 at bridge crossing Wood River, north side of the river. Adjacent land is farmed - fallow in 2001, site is marked with 4 ft x 1/2 inch PVC pipe. 2002: Release site. Photo 2002 P6 - 018. 20% Black and 80% Black Dot established. 2003: Very dense stand of vegetation. Black. Site photo 2003 P9 - 017. GPS1 WP209.
Contact Person: Bob Springer 778-8301; Landowner: Ben, Dwayne and David Filson 472-5914

RM 74 Wood River SE 20-7-6 W3 SK-C-90-0008	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**1 to 2**	2 x 2	55	45	51.3	22.6	
Monitored in 2001	**<1**		1	35			
Monitored in 2003	**1**		15				

Brown Dot Beetle Release in 1990. N 49.58175 W 106.77189
Comments: 1995: Site has improved slightly, however beetle numbers still down. Monitored on a cool morning. Site is in amongst junkyard. 1999: Phone survey. Beetles present, leafy spurge is reduced at release site. 2001: Site is located west of house, GPS was recorded near the site. Site is 8 miles south on 610, 2 miles west, 1 mile south. House on road with 4 bins. Leafy spurge is thinned out. 2003: Black Dot. 2003 P9 - 015. GPS1 WP174.
Contact Person: Cliff Rusk 472-5692

RM 74 Wood River SE 9-7-7 W3 98 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**3**		20	76			
Monitored in 2002	**30**		3				
Monitored in 2003	**1 to 3**		20	69			

Black Beetle released in 1998. N 49.54236 W 106.75466

Comments: Nearest town; Woodrow. 2001: Site is to small for collection. Black beetles are doing well at the edge of a field in a grassland location. Fewer beetles are found on leafy spurge growing with brush. Very little feeding damage. 2002: Release area Photo 2002 P6 - 019. Black and a few Black Dot established. 2003: Very dense vegetation. Black a few Black Dot. Site photo. 2003 P9 - 021 (left ants, right release site with a few ants). GPS1 WP161.

Contact Person: Bob Springer 778-8301; Landowner: Clifford Rusk 472-5692

RM 74 Wood River NW 10-7-6 W3 98 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**<1**						
Monitored in 2003	**1**		4	84			

Black Beetle released in 1998. N 49.54529 W 106.74895

Comments: Nearest town; Woodrow. Released near bridge. 2001: Located to the left of the Wood River when traveling south. Very little feeding damage. 2003: Beetle on the river flat, very dense vegetation stand. Black 50% and Black Dot 50%. Site photo 2003 P9 - 016. GPS1 WP160.

Contact Person: Bob Springer 778-8301

RM 75 Pinto Creek SW 21-7-7 W3 SK-N-90-0055	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**15 to 20**	unlimited	10	30	89.8	8	

Black Dot Beetle Release in 1990. N 49.5710 W 106.8977

Comments: 1995: Excellent collection site, 19 collections in total were made. 1999: Phone survey. Ample beetles, leafy spurge stand is reduced. Site is on the Meyronne Provincial Pasture.

Contact Person: Al Bakke 694-3535

RM 79 Arlington NW 28-7-21 W3 Springer Late 1980^{s}	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**1 to 2**		2	40			

Black Dot released in the late 1980's. N 49.58462 W 108.78555

Comments: Sunny, warm, very little wind when monitored in 2000. Organic producer. Excellent control. Producer (Susan ?) is happy with control. GPS1 WP013.

Contact Person: Mike Sherven 478-2323; Trevor Lennox 297-5450; B. Springer 778-8301

RM 79 Arlington W 27-7-21 W3 SK-C-90-0009	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**15 to 20**	unlimited	30	40	52	23	

Brown Dot Beetle Release in 1990. N 49.5892 W 108.7779
Comments: 1995: Site doing very well, amount of spurge has been dramatically reduced. 1999: Phone survey. Beetles disappeared, so site was sprayed with Tordon 22K in 1998. 2001: Site lost.
Contact Person: Howard Bock 295-3875

RM 99 Caledonia NW 01-12-20 W2 Carlson 99a	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

2000 Black beetles released on July 14, 2003. N 49.97088 W 104.61545
Comments: Released on waste land. NE of yard, take road from south. GPS2 WP434.
Contact Person: C. W. Carlson 586-4602; Landowner: Steve and Joanne McCheyne 586-1936

RM 99 Caledonia SW 01-12-20 W2 Carlson 99b	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

2000 Black beetles released on July 14, 2003. N 49.96693 W 104.60817
Comments: Released on waste land in a water run. GPS2 WP435.
Contact Person: C. W. Carlson 586-4602; Renter Howard Ross 436-4433

RM 99 Caledonia NE 11-12-20 W2 Carlson 99c	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

2000 Brown Dot beetles released on July 16, 2003. N 49.83592 W 104.6298
Comments: Released on wildlife land, 100 ft SW of wooden bridge. GPS2 WP436.
Contact Person: C. W. Carlson 586-4602; Landowner: Conrad Olson 787-2385

RM 99 Caledonia SW 12-12-20 W2 Carlson 99d	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

2000 Brown Dot beetles released on July 16, 2003. N 49.97980 W 104.62208
Comments: Released on waste land, south of road. GPS2 WP437.
Contact Person: C. W. Carlson 586-4602; Renter Howard Ross 436-4433

RM 99 Caledonia NW 01-12-20 W2 Carlson 99e	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

2000 Brown Dot beetles released on July 16, 2003. N 49.84362 W 104.61875

Comments: Released on waste land, south of road and across field. GPS2 WP438.

Contact Person: C. W. Carlson 586-4602; Landowner: Steve and Joanne McCheyne 586-1936

RM 108 Name NE 31-11-18 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**<1**		30	38			

Black Beetle released in 1998. N 49.95754 W 108.44274

Comments: Nearest town; Gull Lake. 2001: Some beetles were released north 1000 - 2000 ft up the valley, 3/sweep, beetles are all over the patch. GPS1 WP144.

Contact Person: Trevor Lenox 297-5450, Landowner: Morley Johnson 672-3643

RM 109 Carmichael NE-11-11-20 W3 SK-N-88-0017	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**2 to 4**	70 x 30	25	30	57	23.5	
Monitored in 2001	**1**		10	30			

Black Dot Beetle Release in 1988. N 49.90010 W 108.62002

Comments: 1995: All that remains is isolated pockets of spurge. The number and density of beetles are down. In 1995, recommend that no collections be made here for a few years. Site not monitored since 1995. 2001: Leafy spurge is thinned out but some plants set seed. Low numbers were recorded because of rain. Many beetles were observed on plant stems. GPS1 WP147.

Contact Person: Howard Wedrick 672-3963

RM 109 Carmichael SE 16-11-20 W3 SK-N-88-0016	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**5**	unlimited	75	65	57	23.5	
Monitored in 2001	**5**		20	35			

Black Dot Beetle Release in 1988. N 49.90373 W 108.66798

Comments: 1995: Area is quite rocky which may be limiting the success of the beetle. In 1995 the site was not improving. Site not visited since 1995. 2001: Leafy spurge is thinned out, but some plans have seed heads. Control was poor in the rocky areas. In 2001, Tordon 22K and Amitrol were applied. A collection site. GPS1 WP145.

Contact Person: Howard Wedrick 672-3963

RM 109 Carmichael SE 16-11-20 W3 1990-93 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**3 to 5**		10	48			

Black Dot Beetle Release in 1990-93. N 49.90423 W 108.66808

Comments: 2001: Tordon 22K and Amitrol were applied. 1 10 ft circle present, within the circle, a few spurge set seed and a small number of plant with vegetative growth were present. GPS1 WP146.

Contact Person: Howard Wedrick 672-3963

RM 125 Chester NE 35-15-7 W2 SK-C-90-0004	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**5**	10 x 2	36	50	61.6	15.1	0

Brown Dot Beetle Release in 1990. N 50.3058 W 102.8536

Site has seriously declined, extent of borders has contracted. Possibly excessive moisture.

Contact Person: Unable to contact Murray Hextall 224-4333

RM 129 Bratt's Lake NW 26-13-21 W2 Carlson 129a	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

500 Brown Dot Beetles Released on July 16, 2003. N 50.11718 W 104.76503

Comments: Released on SK Highways right-of-way, in the south ditch. Unknown herbicide applied. Beetles left in container for an unknown time before release. GPS2 WP439.

Contact Person: C. Carlson 586-4602; Landowner: Regina District, SK Highways

RM 131 Baildon SE 25-15-26 W2 Farmer Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**1 to 3**	3 x 8	85	80			

Brown Dot Beetle Release in 1990. N 50.2840 W 105.4431

Comments: 1995: Site is not doing well. Beetles have moved up slope and away from the stake. There is little evidence of feeding damage and the spurge is very lush. 1999: Phone survey. In 1998, site not doing well.

Contact Person: Don Swenson 693-2157

RM 152 Spy Hill NW 7-19-31 W1 SK-C-90-0005	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	unlimited	25*	40	38	37.6	10*

Brown Dot Beetle Release in 1990. N 50.6167 W 101.7744

Comments: 1995: Excellent site. Spurge is patchy. Beetles located throughout area. 1999: Phone survey. Not an abundant number of beetles. This was a consistent site but trees limited beetle spread. Collection were made in 1997 and 1998.

Contact Person: Bernie Mikolas 745-2579

RM 154 Sakimay Rsv. East of Bl. Dot Band Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	1	20x21	50	60			15

Brown Dot Beetle Release From Maxim in 1991.

Comments:

Contact Person: Ken Acoose 697-2831

RM 154 Sakimay Rsv. South of Bl. Dot Band Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	4	40x16	65	42			40

Brown Dot Beetle Release From Maxim in 1991.

Comments:

Contact Person: Randy Acoose 794-2265

RM 157 South Qu'Appelle NE 10-18-15 W2 SK-C-89-0026	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**5 to 10**	30 x 40	45	50	61.5	20	

Brown Dot Beetle Release in 1989. N 50.5096 W 103.9764

Comments: 1995: Site doing well, beetles in exposed areas. Contact George for 2 mile walk. Site not visited since 1995.

Contact Person: George Pauliuk 699-2511

RM 157 South Qu'Appelle NE 10-18-15 W2 Farmer Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	1	4	70	65			

Brown Dot Beetle Release in 1990 From Maxim. N 50.5096 W 103.9764

Comments: 1995: Site doing poorly with little evidence of damage. Spurge is very lush, shading the beetles. Site monitored on a cool day with wet conditions. Site not visited since 1995.

Contact Person: George Pauliuk 699-2511

RM 157 McLean George Pauliuk's Farmer Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**2 to 3**	3 x 4	75	60			

Brown Dot Beetle Release in 1991 From Maxim.
Comments: 1995: Little evidence of insect damage present, site doing poorly. Site not visited since 1995.
Contact Person: George Pauliuk 699-2511

RM 158 Edenwold NW 9-17-17 W2 Rapp1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

1000 released on July 15, 2003	N 50.4259	W 104.2915 Cal

Comments:
Contact Person: Landowner: Ron Preikchat 761-0263

RM 158 Edenwold SW 10-19-18 W2 Rapp2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

1000 released on July 15, 2003.	N 50.5859	W 104.4240 Cal

Comments:
Contact Person: Landowner: Shirley Agosowicz 781-4716

RM 158 Edenwold SW 18-17-17 W2 SCWW	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2003	**1**		6	69			

Black beetles released on 31 July 2000.	N 50.42655	W 104.33625

Comments: 2000: Released SE on Highway 48 from White City, to Edott Rd., turn south past the first yard on the east side, enter the gate, head SE across pasture to creek bottom. 2003: Black 100%. Site photo and patch to south with no beetles. 2003 P9 - 012, 013. GPS2 WP300.
Contact Persons: Neal Wilson 787-1786 SWA; Landowner: Paul Sattler 771-2043

RM 158 Edenwold NW 7-17-17 W2 SWCC	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2003	**0**		0				

Black beetles released on 31 July 2000.	N 50.41959	W 104.33517

Comments: 2000: Released SE on Highway 48 from White City, to Edott Rd., turn south past the first yard on the east side, enter the gate, head SE across pasture to creek bottom. 2003: No LS plants found, hay field cut and baled. GPS2 WP301.
Contact Person: Neal Wilson 787-1786 SWA; Landowner: Paul Sattler 771-2043

RM 158 Edenwold NW 9-17-17 W2 SK-N-91-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**1 to 2**	5 x 10	75	80	91.3	3.28	

Black Dot Beetle Release in 1991. N 50.4223 W 104.2858

Comments: 1995: Site monitored on a cool breezy day, no significant evidence of insect damage. 1999: Phone survey. Few beetles in 1997, very little leafy spurge stand reduction.

Contact Person: Jim Sigmeth 771-2681

RM 158 White Butte Trails SE 26-17-18 W2 AC-96-005	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**1**		2				
Monitored in 2002	**1 to 5**		3				
Monitored in 2003	**30**		2	36			

Black released in 1996. N 50.45758 W 104.36787

Comments: Nearest City: Pilot Butte. 2000: From this site, 2 new site were put out in 1997, one site south of the gate, on this site some leafy spurge seed head reduction is visible. 2002: Lama and sheep, release site (2), Photo 2002 P8 - 007, 008. 5/sweep at the south stake (A) and 1/sweep at the north stake (B). 2003: In photo, old LS skeletons in foreground show remains of old patch. N stake is 40m north of S stake. Black 100%. Photos, S stake (middle 7/sw, right 11/sw), S stake, N stake. 2003 P9 - 010, 011. GPS1 WP065.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 158 White Butte Trails NW 26-17-18 W2 AC-96-006	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**0**						
Monitored in 2003	**0**		8	36			

Black released in 1996. N 50.46913 W 104.37696

Comments: Nearest City: Pilot Butte. Found a lot of ants on the release site. 2003: Site photo. 2003 P9 - 006. GPS1 WP066.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 158 White Butte Trails NE 26-17-18 W2 AC-96-007	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**2 to 5**		20				
Monitored in 2002	**>1 to 1**		11				
Monitored in 2003	**1 to 5**		3 to 10	8 to 25			

Black released in 1996. N 50.46562 W 104.38278

Comments: Nearest City: Pilot Butte. Two release sites nearby, only one established, A SE area looked after by SWF. 2002: Release site. Photo 2002 P8 - 004, 005. A is 1st stake (1 Black Dot/sweep) and B is 2ond stake (<1 Black/sweep). SWF land. There is a lot of litter on the soil. 2003: Black 100%. N site (1 - 3/sw), S site (1 - 5/sw). In the opening 10/sw, all Black. N and S Site photos. 2003 P9 - 007, 008. GPS1 WP067.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 158 Edenwold SW 10-19-18 W2 Rel 97	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**3**	18	10	50			
Monitored in 2002	**<1 to 2**		2				
Monitored in 2003	**4 and 1 to 10**		10	36			

Black released in 1997. N 50.59318 W 104.43122

Comments: 1999: Beetles are expanding in a holding pasture for horses. 2002: Photo 2002 P8 - 011. Pasture not grazed. <1 near stake and 1 - 2 along the fence. To much litter. 2003: Black 100%. Beetles in leafy spurge along the fence. 2003 P3 - 3, P9 - 014 (1/sw by stake and 11/sw by corner). GPS1 WP215.

Contact Person:

RM 159 City of Regina NW 33-17-20 W2 SK-C-91-0005	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1992	**0**	0	60	38			50
Monitored in 1993	**0**	0	60	38			50
Monitored in 2002	**<1**		0				
Monitored in 2003	**2 to 8 3 to 7**		8	36			

Brown Dot Beetle released during 1991. N 50.47692 W 104.69602

Comments: 1993: Site died out by the Normanview Pines apartments. 2001: About 1996 several releases of black beetles were made on this parcel of industrial land. This site by the Joanne Goulet Golf Course became an excellent site for collection. On the site most of the beetles were black but some were brown dot. By 2001, the population of leafy spurge had complete disappeared. 2002: Area, short leafy spurge, close up. Photo 2002 P8 - 001, 002, 003. Black and Black Dot. JGCC. 2003: Site photo. 2003 P1 - 001, 002 Black 100%. Photos 25 paces from fence, going east. 2003 P7 - 001, 002, 003, 004, 005, 006, 007, 008, 009, 010. GPS1 WP162.

Contact Person:

RM 159 City of Regina SW 27-17-20 W2 Island	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**25**	unlimited	25	30		heavy	
Monitored in 2001	**1**						

Black Spurge Beetle Release (*A. lacertosa*) in 1991. N 50.45838 W 104.66999

Comments: 1995: Site doing excellent. Significant reduction in the amount of spurge present. Beetles were collected and moved to northwest corner of Regina along creek. 1999: Phone survey. In 1997 beetles present, leafy spurge stand is reduced. GPS1 WP138.

Contact Person: Taz Stewart 777-7730

RM 159 City of Regina SW 27-17-20 W2 Island	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**12**			50			

Black Spurge Beetle Release (*A. lacertosa*) in 1991. N 50.45838 W 104.66999

Comments: 1995: Site doing excellent. Significant reduction in the amount of spurge present. Beetles were collected and moved to northwest corner of Regina along creek. 1999: Phone survey. In 1997 beetles present, leafy spurge stand is reduced. 2001: Reduced leafy spurge density but some plants flowered and set seed. GPS1 WP138.

Contact Person: Taz Stewart 777-7730

RM 159 City of Regina NW 28-17-19 W2 Rel 98	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**1**	13					
Monitored in 2000	**2 to 7**		<1				
Monitored in 2001	**1 to 2**						
Monitored in 2002	**1 to 2**						
Monitored in 2003	**1**		0	10			

Black Beetle released in 1998. N 50.46356 W 104.56072

Comments: 2000: Herbicides were applied in strips but all of the area was not sprayed. Leafy spurge was sampled outside the herbicide treated areas. 2001: 1 beetle/sweep was found in the herbicide treated area and 2 beetles/sweep was found in the non-herbicide treated patches. Leafy spurge is thinned and is not in patches. Herbicides were applies in strips and beetles were found on herbicide treated plants. 2002: Release area. Photo 2002 P7 025, 026. Lots of ants. Site mowed. 2003: Very few plants and beetles. Site photo and plant. 2003 P7 - 011, 012. GPS1 WP064.

Contact Person: A. Sandalack 777-7081; Landowner: City of Regina

RM 160 Pense NE-19-18-24 W2 SK-N-89-0021	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**8 to 10**	80 x 150	35	45	81.5	10	

Black Dot Beetle Release in 1989. N 50.5388 W 105.2825

Comments: 1995: Site doing very well. Beetles have moved uphill. Large number of non-flowering stems. Collections can be made at this site. 1999: Phone survey. Beetle present.

Contact Person: Brian Short 345-2514

RM 161 Moose Jaw SW 33-16-26 W2 Black Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**5**	8	35	26			
Monitored in 2001	**1**		20	50			
Monitored in 2002	**1**		5				
Monitored in 2003	**3 to 4**		5	51			

Black released in ??? N 50.38296 W 105.51910

Comments: Released to the left of the tree. Brown dot were found further to the north. 2001: Released by Dale Risula. Leafy spurge is thinned out but there are seed heads. 2002: Release area. Photo 2002 P8 - 26, P9 - 001. 2003: Black and a few Black Dot. Site photo. 2003 P8 - 023. GPS1 WP155.

Contact Person:

RM 161 Moose Jaw SW 33-16-26 W2 Br Dot Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**3**		20	46			
Monitored in 2002	**2**		1				
Monitored in 2003	**3 to 4**		1	56			

Br Dot released in 1998 N 50.38312 W 105.51874

Comments: Brown dot were found further to the north black beetle release site. 2001: City released to the north of a previous release by the stake. Many vegetative shoots with a few plants with seed heads. 2002: Release site, close up, area. Photo 2002 P9 - 002, 003, 004. Black with a few Black Dot. 2003: Black 60% and Black Dot 40%. Site photo (Blacks in tree shade). 2003 P8 - 024. GPS1 WP156.

Contact Person:

RM 161 Moose Jaw Water Reservoir City Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2003	**6 to 10**		1	30			

Released date unknown N 50.38512 W 105.62129

Comments: 2003: Released north of birdhouse. Mostly Black, few Black Dot. Site photo. 2003 P8 - 022. GPS1 WP023.

Contact Person: Glen Chernick 694-4439

RM 161 Moose Jaw Wakamow Valley Farmer Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**50**	unlimited	35	25			40

Brown Dot Beetle Release in 1991.
Comments: 1995: Previous to 1994, the site was doing extremely well. 1999: Phone survey. In 1998, presence of beetles unknown and no sign of leafy spurge reduction.
Contact Person: Glen Chernick 694-4439

RM 162 Besant Campground NW 29-17-29 W2 1998 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**20**	30m	18	21			
Monitored in 2001	**5 to 15**		5	35			
Monitored in 2002	**3**		10				
Monitored in 2003	**10**		20	53			

Black Beetle released in 1998. N 50.46338 W 105.96128
Comments: 1999: Excellent site. 2001: Leafy spurge is thinned out but some plants are setting seed. A collection site. 2002: Release area. Site, close up, area. Photo 2002 P8 - 017, 018, 019. Black and a few Black Dot. 2003: Site photo. 2003 P4 - 008. GPS1 WP139.
Contact Person:

RM 161 Moose Jaw SW 35-16-27 W2 1998 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**2**						
Monitored in 2001	**<1**		5	35			
Monitored in 2002	**<1**		20				
Monitored in 2003	**0**		8	64			

Black Beetle Released in 1998. N 50.38488 W 105.61079
Comments: 1999: Could not find the release site. 2001: Leafy spurge appears thin but many of the plants have seed heads. 2002: Release area, area. Photo 2002 P8 - 024, 025. 2003: Grazed. Site photo 2 hawkmoth. 2003 P8 - 019, 020, 021. GPS1 WP157.
Contact Person: Landowner: Robert Hayward 693-0434

RM 162 Caron NE 29-17-29 W2 SK-N-87-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**1 to 3**	unlimited	40	30	90+		
Monitored in 1999	**30**		10	20			
Monitored in 2002	**3 to 4**		3				
Monitored in 2003	**4 to 7**		4	38			

Black Dot Beetle Release in 1987. N 50.46015 W 105.96267

Comments: 1995: Not many beetles found, possible error in site location as contact was unsure of exact spot. 1999: Excellent site beetles have moved along the road. 2002: Release site, right of release site, left of release site, nearby valley. Photo 2002 P8 - 020, 021, 022, 023. 2003: Not grazed. Black Dot. Site and area photos. 2003 P9 - 004, 005. GPS1 WP217.

Contact Person: Cameron Duffy 692-5121

RM 162 Caron-Besant NW 29-17-29 W2 SK-C-90-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**4 to 6**	6 x 6	80	35			
Monitored in 1999	**15**		6	18			
Monitored in 2001	**4**		1	25			
Monitored in 2002	**2 to 3**		5				
Monitored in 2003	**3 to 6**		18	64			

Brown Dot Beetle Release in 1990. N 50.46015 W 105.96267

Comments: 1995: Specific release point unknown, general site area cleared of spurge with isolated pockets remaining. Beetles may be running out of spurge. 1999: Excellent site. Beetles present, leafy spurge thinned out. 2001: Leafy spurge thinned out but some plants have seed heads. Leafy spurge is cleaned off the hill. 2002: Photo 2002 P8 - 012, 013, 014, 015 (release area), 016 (release area). Site is on the walking trail behind the campground. 2003: Photo 2003 P4 - 009. GPS1 WP216.

Contact Person:

RM 162 Caron-Besant NW 29-17-29 W2 SK-N-91-0007	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10 to 20**	unlimited	30	35	96.7	1.84	

Bl Dot Beetle Release in 1990. N 50.4660 W 105.9585

Comments: 1995: Excellent site, 11 collections were made. Beetles have advanced to cover entire hillside. 1999: Phone survey. Number unknown, may have controlled leafy spurge. 2001: Few black beetles present.

Contact Person:

RM 163 Wheatlands SW 13-17-1 W3 SK-N-86-0004	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10**	unlimited	30	40	58	17	5

Black Dot Beetle Release in 1986. N 50.4296 W 106.0172

Comments: 1995: Beetles found throughout area in varying densities. Approx. 12 collections made. 1999: Phone survey. Beetles are present, spurge is reduced in release area. This site is adjacent to the sheep pasture. 2001: poor site, no evidence of damage.

Contact Person: Ed. Jaeger 355-2716 or 355-2233 (RM)

RM 163 Wheatlands SW 3-18-2 W3 SK-N-90-0053	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10**	unlimited	30	30	88.1	7.06	10
Monitored in 2001	3		5	40			
Monitored in 2003	**8 to 9**		8	38			

Brown Dot Beetle Release in 1990. N 50.48777 W 106.20914

Comments: 1995: Beetles present in decent numbers, spurge still dominant (somewhat patchy). Approximately 10 collections made. 1999: Phone survey. Beetles are present, spurge is reduced in release area. 2001: Leafy spurge is thinned out, some seed heads. A large area has been thinned out. 2003: Grazed. Black Dot. Site photo, LS thinned out, LS on left has 7/sw. 2003 P9 - 001, 002, 003. GPS1 WP158.

Contact Person: Ed. Jaeger 355-2716 or 355-2233 (RM)

RM 163 Wheatlands SW 26-17-1 W3 SK-C-92-0020	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	15 x 3	30	33			30

Brown Dot Beetle Release in 1992. N 50.4587 W 106.0401

Comments: 1995: Site took well, doing well. 1999: Phone survey. Beetles are present, spurge is reduced in release area. 2001: Small patch in a cultivated field. Will never be a collection site.

Contact Person: Ed. Jaeger 355-2716 or 355-2233 (RM)

RM 184 Grayson NW 29-18-4 W2 SK-N-87-0003	**No. of Beetles / Sweep**	**Beetle** Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**2 to 50**	unlimited	0 to 2	10	39	33.8	15

Black Dot Beetle Release in 1987. N 50.5533 W 102.5212

Comments: 1995: Site not checked in 1995. Previously the site was doing excellent with significant spurge reduction and beetle collections made. Few beetles at release site, they have moved along the hills to the adjacent south facing slope. 1999: Phone survey. Beetles active, leafy spurge is reduced.

Contact Person: David Safton 696-2975

RM 184 Grayson NW 29-18-4 W2 SK-C-86-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	1	unknown	60	60	52	24	5

Brown Dot Beetle Release in 1986. N 50.5533 W 102.5212

Comments: 1995: Site not checked in 1995. 1999: Phone survey. Beetles active, leafy spurge is reduced as are the beetle numbers.

Contact Person: David Safton 696-2975

RM 185 McLeod SE 16-21-9 W2 SK-C-91-0013	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**1 to 3**	2 x 3	40	30			10

Brown Dot Beetle Release in 1991. N 50.8009 W 103.1909

Comments: 1995: Beetles present but not in sufficient numbers to collect.

Contact Person: Unable to contact, Murray Hanowski 748-2233

RM 185 McLeod SW 4-21-9 W2 SK-C-92-0026	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	1	2 x 11	65	70			5

Brown Dot Beetle Release in 1992. N 50.7714 W 103.2026

Comments: In 1996, beetles present and leafy spurge reduced at release stake.

Contact Person: Garry Lubachowski 335-2791

RM 189 Lumsden NW 15-21-22 W2 SCWW wpt 62	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**2**		0				
Monitored in 2003	**3 to 12**		2	33			

Mostly black beetles released on June 28, 2000 N 50.78410 W 104.97673

Comments: 2000: North end of pasture, west of the entrance from the highway. 2002: Release site. Photo 2002 P7 - 021. Pasture was sheep grazed. 2003: very light grazing. Black 100%. Site photo (most beetles near flowering plants). 2003 P7 - 014. GPS2 WP302.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Jamie Sinclair.

RM 189 Lumsden SW 15-21-22 W2 SCWW wpt 61	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	<1		0				
Monitored in 2003	**3 to 13**		0				

Mostly black beetles released on June 28, 2000 N 50.78195 W 104.96822

Comments: 2000: SE of highway entrance on edge of patch near wolfwillow. 2002: Release site. Photo 2002 P7 - 022. Pasture was sheep grazed, sheep rotated. 2003: Very light grazing. Mostly Black Dot, few Blacks. Site photo and patch in background. 2003 P7 - 015, 016, 017. GPS2 WP303.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Jamie Sinclair.

RM 189 Lumsden SE 1-21-22 W2 SCWW wpt	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	1		20				
Monitored in 2003	**1 to 2**		17	64			

Mostly black beetles released on June 28, 2000 N 50.74832 W 104.91576

Comments: 2000: East of trough towards east fence boundary. 2002: Release area. Photo 2002 P5 - 25. Black Dot. 2003: Pasture grazed. Site photo. 2003 P8 - 012. GPS2 WP304.

Contact Person: J. Oliver 535-9760 SWA; Landowner: George Grassick

RM 189 Lumsden SE 1-21-22 W2 SCWW wpt 67	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**10**		4				
Monitored in 2003	**3**		1	30			

Mostly black beetles released on June 29, 2000 N 50.75015 W 104.91799

Comments: 2000: At edge of 4th transect east-end of quarter section. 2002: Photo 2002 P6 - 003. Most are Black Dot in the middle of the patch which has thinned. 2003: No grazing. Black Dot. Site photo. 2003 P8 - 006. GPS2 WP305.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Gord Ewen.

RM 189 Lumsden NW 1-21-22 W2 SCWW wpt 69	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		5				

Mostly black beetles released on June 28, 2000 N 50.75383 W 104.93170

Comments: 2000: Fenceline between Harrison's and Ewen's, south of Harrison's yard. 2002: Photo 2002 P6 - 004. Mostly Black Dots with a few Black beetles. Released near a fenceline. A low number of leafy spurge plants present. GPS2 WP306.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Tom Harrison

RM 189 Lumsden NE 11-21-22 W2 SCWW wpt 64	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	1		10				
Monitored in 2003	3		5	41			

Mostly black beetles released on June 29, 2000 N 50.77325 W 104.94150
Comments: 2000: Release site. Photo 2002 P6 - 007. Directly across from 2nd railway tie from fence. Black Dot. 2003: No grazing. Black Dot. Site photo. 2003 P8 - 001. GPS2 WP307.
Contact Person: J. Oliver 535-9760 SWA; Landowner: Doug Danyliw

RM 189 Lumsden NE 11-21-22 W2 SCWW wpt 63	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	<1		10				
Monitored in 2003	1		3	38			

Mostly black beetles released on July 10, 2000 N 50.77310 W 104.94035
Comments: 2000: Close to 2nd railway tie from the fence. 2002: Release site. Photo 2002 P6 - 008. Black Dot. 2003: Black Do. No grazing. Site photos. 2003 P7 - 024, 025. GPS2 WP308.
Contact Person: J. Oliver 535-9760 SWA; Landowner: Doug Daniela

RM 189 Lumsden NE 11-21-22 W2 SCWW wpt 66	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	4		5				
Monitored in 2003	1		0	15			

Mostly black beetles released on July 10, 2000 N 50.77253 W 104.94155
Comments: 2002: Photo 2002 P6 - 006. Black Dot with a few Black beetles. Beetles on leafy spurge growing with grass and not on leafy spurge growing with wolf willow. 2003: No grazing. Few plants. Site photo. 2003 P8 - 002. GPS WP309.
Contact Person: J. Oliver 535-9760 SWA; Landowner: Doug Danyliw

RM 189 Lumsden NE 11-21-22 W2 SCWW wpt 65	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**6 to 7**		3				
Monitored in 2003	**8 to 19**		2	36			

Mostly black beetles released on July 10, 2000 N 50.77101 W 104.94074
Comments: 2000: Three posts from birdhouse, 13 railway ties south from the gate. 2002: Release site. Photo 2002 P6 - 005. Mostly Black Dots with a few Black beetles. 2003: No grazing. Black Dot and a few Blacks. Site photo and Buena Vesta with LS. 2003 P8 - 003, 004, 005. GPS2 WP310.
Contact Person: J. Oliver 535-9760 SWA; Landowner: Doug Danyliw

RM 189 Lumsden SW 15-21-22 W2 SCWW wpt 60	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1**		0				
Monitored in 2003	**2 to 8**		1	38			

Mostly black beetles released on July 10, 2000 N 50.77914 W 104.96908

Comments: 2000: South end of 1/2 section, near tress, north of pit. 2002: Release site. Photo 2002 P7 - 023. Pasture was sheep grazed, sheep rotated. 2003: Site photo (1/sw), site and background (tall LS 1/sw, low is 8/sw). 2003 P7 - 018, 019, 020. GPS2 WP311.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Janie Sinclair

RM 189 Lumsden SW 15-21-22 W2 SCWW wpt 59	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**7**		0				
Monitored in 2003	**1 to 5**		10	48			

Mostly black beetles released on July 10, 2000 N 50.77685 W 104.96865

Comments: 2000: South end of 1/2 section, near tress, north of pit. 2002: Release site. Photo 2002 P7 - 024. Pasture was sheep grazed. More bare ground than other sites in the area. 2003: Very light grazing. Black Dot. Site photo (1/sw), near back (3/sw) in back (6/sw), site large LS (5/sw). 2003 P7 - 021, 022, 023. GPS2 WP312.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Janie Sinclair

RM 189 Lumsden SE 1-21-22 W2 SCWW wpt	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**3 to 6**		3				
Monitored in 2003	**11**		15	41			

Mostly black beetles released on July 10, 2000 N 50.74930 W 104.91615

Comments: 2002: Releas4 area. Photo 2002 P6 - 001. Black Dot. 2003: Pasture grazed. Site photo. 2003 P8 - 013. GPS2 WP313.

Contact Person: J. Oliver 535-9760 SWA; Landowner: George Grassick

RM 189 Lumsden SE 1-21-22 W2 SCWW wpt 38	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**3 to 5**		8				
Monitored in 2003	**2 to 4**		9	43			

Mostly black beetles released on July 10, 2000 N 50.74978 W 104.91705

Comments: 2000: Along roadside on east side before brush, in gap between tree stand. 2002: Photo 2002 P6 - 002. Mostly Black Dot, a few Black beetles were found behind the stake in the photo with western snowberry. 2003: No grazing. Black Dot. Site photo. 2003 P8 - 008. GPS2 WP314.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Gord Ewen

RM 189 Lumsden SE 1-21-22 W2 SCWW wpt 31	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**3 to 5**		5 to 12				
Monitored in 2003	**3 to 5**		1	28			

Mostly black beetles released on July 10, 2000 N 50.74833 W 104.91752

Comments: 2000: Directly west of Grassick's trough, up on ridge. 2002: Photo 2002 P5 - 022, 023. 3 to 5/sweep by the rebar and 3/sweep by the red stake. 2003: No grazing. Black Dot. Site photo (3/sw by stake, 5 right stake 5/sw) 2003 P8 - 010. GPS2 WP315.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Gord Ewen

RM 189 Lumsden SE 1-21-22 W2 SCWW wpt 68	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**3 to 5**		8				
Monitored in 2003	**3 to 7**		5	41			

Mostly black beetles released on July 10, 2000 N 50.74778 W 104.91835

Comments: 2000: North of bush on road, running east-west. 2002: Release site. Photo 2002 P5 - 024. By rebar. No grazing. Black Dot. Site photo (3/sw foreground, 7/sw background). 2003 P8 - 011. GPS2 WP316.

Contact Person: J. Oliver 535-9760 SWA; Landowner: Gord Ewen

RM 189 Lumsden SE 1-21-22 W2 SK-C-91-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	<1	n/a	50	70	69.4	11.5	10
Monitored in 2000	**3 to 5**	150	20 - 30				
Monitored in 2002	**1**		0				
Monitored in 2003	**13 to 33**		6	43			

Brown Dot Beetle Release in 1991. N 50.74900 W 104.91778

Comments: Site has seriously declined for unknown reason. 2000: Beetles are present but are not significantly controlling leafy spurge, small number of beetles over a large area. 2002: Release site. Photo 2002 P7 - 019. Pasture was sheep grazed. 2003: No grazing. Black Dot. Site photo. 2003 P8 - 009. GPS1 WP061.

Contact Person: Gord Even, Leonard Ebert 731-2706

RM 189 Lumsden SE 1-21-22 W2 SK-C-92-0002	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**<1**	n/a	50	70			10
Monitored in 2000	**5 to 10**	30	2 to 20				
Monitored in 2002	**5**		0				
Monitored in 2003	**2 to 11**		11	48			

Brown Dot Beetle Release in 1992. N 50.74978 W 104.91750

Comments: 1995: Site not doing well. Site is located close to a busy road, which may be why it is unsuccessful. 2000: Damage starting. In 2000, sheep grazed the pasture for the first time. 2002: Release site. Photo 2002 P7 - 016, 017, 018. Pasture was sheep grazed. 2003: No grazing. Black Dot. Site photo (11/sw in foreground, 3/sw background) 2003 P8 - 007. GPS1 WP060.

Contact Person: Gord Even, Leonard Ebert 731-2706

RM 189 Lumsden NW 15-21-22 W2 Black Rel	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**5 to 7**	9	1				
Monitored in 2002	**0**		0				
Monitored in 2003	**3 to 6**		2	36			

Black Beetle released in ???. N 50.78505 W 104.98892

Comments: 2000: There is a circle around the stake with excellent control. 2002: Release site. Photo 2002 P7 - 020. No leafy spurge found. 2003: Very light grazing. Black 100%. Site photo. 2003 P7 - 013. GPS1 WP062.

Contact Person: Gord Even, Leonard Ebert 731-2706

RM 190 Dufferin NW 5-19-24 W2 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**1**		10	76			

Black Beetle released in 1998. N 50.57683 W 105.28085

Comments: Nearest town; Tugaske. GPS1 WP036.

Contact Person: Doug Patience 638-4967, Landowner: Delbert Schmidt 759-2502

RM 190 Dufferin SW 4-19-24 W2 SK-N-89-0010	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>>20**	unlimited	0	0	63	18	10
Monitored in 2001	**8 to 10**		10				

Black Beetle Release in 1989. N 50.5750 W 105.2724

Comments: 1995: Beetles have killed off all spurge within vicinity of release point and have spread to spurge within trees. Approx. 15 collections made. Some beetles relocated. 1999: Phone survey. In 1998, few beetles at release site, beetles moved 1/4 mile, at original site spurge is almost gone. 2001: Walk in 1 mile. The beetles have stunted the plants. Most of the beetles are in the grassland site but a few are in the trees. GPS1 WP115.
Contact Person: Doug Patience 638-4967

RM 190 Dufferin SE 5-19-24 W2 Br Dot Rel 94	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	7	20	8 to 12	71			

Brown dot released in 1994 N 50.57575 W 105.28525

Comments: Put in a partial shade area. Beetles moved to a sunny location, spurge is thinner. GPS1 WP014.

Contact Person: Doug Patience 638-4967

RM 190 Dufferin SW 5-19-24 W2 Black 98 Rel	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	1		10	76			

Black released in 1998. N 50.57698 W 105.28085
Comments: Brown dots are present, they came from a nearby release site 300 m. GPS1 WP015.
Contact Person: Doug Patience 638-4967

RM 190 Dufferin SW 4-19-24 W2 Rel 1998	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	10	30 x 60	6	60			

Black Beetle released in 1989. N 50.57810 W 105.27775
Comments: Nearest town; Bethune, Control in brush, leafy spurge plants, short and not growing. In areas with small spurge there are ants. GPS1 WP012.
Contact Person: Doug Patience 638-4967, Landowner: Deer Valley Ranch 693-6611

RM 191 Marquis NW 13-21-29 W2 SK-N-87-0004	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**60 to 80**	unlimited	60	70	58	21.5	0

Black Dot Beetle Release in 1987. N 50.7861 W 105.8957

Comments: 1995: Could not monitor in 1995 due to inclement weather conditions. Beetles are at the top of the hill. 1999: Phone survey. Beetles are plentiful.

Contact Person: Larry Smith 759-2656

RM 191 Marquis NE 4-21-28 W2 SK-C-91-0011	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**1 to 2**	3 x 0	80	85	59.7	15.6	0

Brown Dot Beetle Release in 1991. N 50.7569 W 105.8149

Comments: 1995: Could not monitor in 1995 due to inclement weather conditions. 1999: Phone survey. Site not visited for several years.

Contact Person: Landowner: Claudette Haliday, Lynn Anderson 788-4804

RM 191 Buffalo Pound Park release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**2**	4 x 5	75	65			

Brown Dot Beetle Release in 1991 From Maxim.

Comments: 1995: Site doing poorly, possibly due to excessive moisture or shade from trees. Site located north of Minoa release. 1999: Phone survey. In 1998, beetles are present.

Contact Person: Terry Minter 694-3659 or Sherri at the Park 694-3819

RM 191 Buffalo Pound Park release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**3**	7 x 10	45	40			
Monitored in 1999	**1**	13 m	5	66			
Monitored in 2003	**3 to 4**		9	56			

Brown Dot Beetle Release in 1991 From Maxim. N 50.58787 W 105.42287

Release west of entry gate. Release point not staked. Beetles returning to area. Minimal spurge in area as it was sprayed. In 1998, beetles are present. 1999: Leafy spurge is thin but not shorter. 2003: Park. Black Dot 80% and Black 20%. Site photo. 2003 P8 - 018. GPS1 WP016.

Contact Person: Terry Minter 694-3659 or Sherri at the Park 694-3819

RM 191 Buffalo Pound Park release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**2 to 4**	20 x10	70	80			

Brown Dot Beetle Release in 1991 From Maxim.

Comments: 1995: Site located at bottom of river valley. Site doing poorly, likely due to excessive moisture. 1999: Phone survey. In 1998, beetles are present.

Contact Person: Terry Minter 694-3659 or Sherri at the Park 694-3819

RM 191 Buffalo Pound Minoa	**No. of moths**	Colony Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**0**						

Minoa murinata Release in 1991.

Comments: 1995: No evidence of Minoa adults, eggs, or larvae. No evidence of defoliation, although this would not normally become apparent until population builds up. Difficult to determine survival. 1999: Phone survey. Success unknown.

Contact Person: Terry Minter 694-3659 or Sherri at the Park 694-3819

RM 191 Buffalo Pound SE 8-19-25 W2 Bl Dot Rel 1994	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**2 to 6**		5	22			
Monitored in 2003	**11 to 12**		9	43			

Black Dot released in 1994. N 50.58998 W 105.4168

Comments: 1999: Good control around the stake (2/sweep), better control where beetles moved (6/sweep), did not move uphill because of ants. 2003: Black Dot 60% and Black 40%. Site photo. 2003 P8 - 016. GPS1 WP022.

Contact Person: Terry Minter 694-3659 or Sherri at the Park 694-3819

RM 191 Buffalo Pound SE 9-19-25 W2 Black Rel 1998	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**7**	3 x 10	6	45			
Monitored in 2003	**3 to 4**		2	48			

Black released in 1998. N 50.58909 W 105.41580

Comments: Good site, NE slope at top of the hill. 2003: Park. Black 100%. LS shoots not visible in grass. 2003 P8 - 017. GPS1 WP017.

Contact Person: Terry Minter 694-3659 or Sherri at the Park 694-3819

RM 218 Cupar NW 10-22-17 W2 SK-N-89-0015	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**5 to 10**	10 x 40	35	45	71.5	14	

Black Dot Beetle Release in 1989. N 50.8588 W 104.2797
Comments: 1995: Site has improved since 1994. Beetles have moved up and down the slope.
Contact Person: Unable to contact Alan Orb (no phone number)

RM 218 Cupar NW 10-22-17 W2 SK-C-92-0027	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**3**	0	85	70			

Brown Dot Beetle Release in 1992. N 50.8588 W 104.2797
Site not doing well, recommend re-release.
Contact Person: Unable to contact Alan Orb (no phone number)

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 125 LML V	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2003	**15 to 17**		12	43			

Mostly black beetles released on 22 June 2001 N 50.77360 W 104.87700
Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508673 M 5624438. 2002: Site is located in a bush area with no leafy spurge. 2003: Black 60% and Black - Brown Dot 40%. Site photo. 2003 P5 - 015. GPS2 WP323.
Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 126 LML VI	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2002	**2 to 3**		15				
Monitored 2003	**20**		5	41			

Mostly black beetles released on 22 June 2001 N 50.77277 W 104.87652
Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508707 M 5624345. 2002: Release site. Photo 2002 P7 - 011. Black and Black Dot established. 2003: Black 60% and Black - Brown Dot 40%. Site photos, site (20/sw), nearby patch (35/sw), next nearby patch (11/sw). 2003 P5 - 012, 013, 014. GPS2 WP324.
Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 127 LML VII	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2002	**2 to 3**		10				
Monitored 2003	**20 - 21**		1	25			

Mostly black beetles released on 22 June 2001 N 50.77252 W 104.87668

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508696 M 5624316. 2002: Release area. Photo 2002 P7 - 012. Estimate made on the north side of the rock. 2003: Black 50% and Black - Brown Dot 50%. Site photos 2003 P5 - 010, 011. GPS2 WP325.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 128 LML VIII	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**3**		10				
Monitored in 2003	**3 to 8**		5	33			

Mostly black beetles released on 22 June 2001 N 50.77214 W 104.87707

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508668 M 5624274. 2002: Top hill, facing east. Photo 2002 P5 - 006. 2003: Black 50% and Black - Brown Dot 50%. Site photo. 2003 P5 - 009. GPS2 WP326.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 129 IX	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2002	**1**		5				

Mostly black beetles released on 22 June 2001 N 50.77080 W 104.87582

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508757 M 5624126. 2002: Photo 2002 P7 - 014, 015. Black established. Site is an opening in the woods, the next open site to the north had 4/sweep (50% Black and 50% Black Dot). GPS2 WP327.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 030 LML X	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2003	**3**		1	68			

Mostly black beetles released on 22 June 2001 N 50.77142 W 104.87542

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508785 M 5624195. 2002: Could not find the site, GPS reading is a heavy shrub-wood area. 2003: Black 100%. Back of site photo, and site photos. 2003 P6 - 008, 009. GPS2 WP328.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 031 XI	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		10				
Monitored in 2003	**15 to 18**		7	51			

Mostly black beetles released on 22 June 2001 N 50.77259 W 104.87810

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508596 M 5624324. 2002: Photo 2002 P5 - 009. 1st patch and 2nd patch are Black, 3rd patch are Black Dot. 2003: Black 60%, Black dot 40%. Site photo. 2003 P5 - 006. GPS2 WP329.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 121 LML I	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2002	**4 to 6**		5				
Monitored 2003	**20 - 25**		6	53			

Mostly black beetles released on 22 June 2001 N 50.77408 W 104.87733

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508650 M 5624490. 2002: Release area. Photo 2002 P5 - 014. 2003: Black 100%. Site photo and next patch (25/sw). 2003 P5 - 016, 017. GPS2 WP330.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 122 LML II	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2002	**11**		5				
Monitored 2003	**13 to 18**		4	58			

Mostly black beetles released on 22 June 2001 N 50.77443 W 104.87770

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508624 M 5624530. 2002: Release site. Photo 2002 P5 - 012. Top of hill. 2003: 20/sw in leafy spurge by brush. 2003: Black 100%. Site photo. 2003 P5 - 018. GPS2 WP331.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 123 LML III	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**<1**		8				
Monitored in 2003	**2 to 11**		10	41			

Mostly black beetles released on 22 June 2001 N 50.77447 W 104.87818

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508589 M 5624534. 2002: Release site. Photo 2002 P5 - 011. Black and Black Dot. Lots of ants. 2003: Black 95%. Site with lots of flowers (7/sw). Site photo and, patch before and in background. 2003 P5 - 019, 020. GPS2 WP332.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 124 LML IV	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored 2002	**3**		6				
Monitored 2003	**3 to 9**		6	43			

Mostly black beetles released on 22 June 2001 N 50.77395 W 104.87911

Comments: 2001: 4000 beetles released at Last Mountain House Provincial Park. UTM = U 0508524 M 5624478. 2002: Release area. Photo 2002 P5 - 010. 90% Black. 2003: Black 95%. 2003: Site photo. 2003 P5 - 005. GPS2 WP333.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE Kelvin Kelly 778-8496

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 9	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	3		15				
Monitored in 2003	**10 to 12**		10	43			

Mostly black beetles released on July 10, 2000 N 50.77413 W 104.87792

Comments: 2000: On west side of creek, on top of hill next to 1st solid white stake. 2002: Release area, Black on right, Black Dot on left. Photo 2002 P5 - 013. 2003: Black 95%. Site photo, area on west side, area on north side (3 photos). 2003 P5 - 021, 022, 023, 024, 025. GPS2 WP317.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 12	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	1		4				
Monitored in 2003	**3 to 8**		4				

Mostly black beetles released on July 10, 2000 N 50.77222 W 104.87748

Comments: 2000: Top of hill, on west side of creek on east side of plateau. 2002: Release site. Photo 2002 P5 - 007, 008 (Hawk moth). 2003: Black 50% Black Dot 50%. Site photo and patch before and in background of site. 2003 P5 - 007, 008. GPS2 WP318.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE

RM 219 Longlaketon NW 8-21-22 W2 SCWW wpt 18	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**10 to 25**		3				

Mostly black beetles released on July 10, 2000 N 50.77168 W 104.87583

Comments: 2000: 1250 beetles released. Down slope from wpt 12, on west side of creek. 2002: Release site, east facing. Photo 2002 P5 - 005. Mostly black dot, 5% black. GPS2 WP319.

Contact Person: J. Oliver 535-9760 SWA; Landowner: SE

RM 219 Longlaketon NE 8-21-22 W2 SCWW wpt 23	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1**		7				
Monitored in 2003	**1 to 2**		7	30			

Mostly black beetles released on July 10, 2000 N 50.77028 W 104.87320
Comments: 2000: Release site. Photo 2002 P7 - 013. 2500 beetles released. On east side of creek where original camp was planned. 2003: Black 60% and Black - Brown Dot 40%. East top of hill. Site photo (site beyond patch 3/sw). 2003 P6 - 007. GPS2 WP320.
Contact Person: J. Oliver 535-9760 SWA; Landowner: SE

RM 219 Longlaketon NW 18-21-21 W2 SK-C-89-0002	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	25 x 85	40	50			5
Monitored in 2000	**5 to 15**	600	5 to 20				
Monitored in 2002	**8**		8				
Monitored in 2003	**5 to 20**		10	36			

Brown Dot Beetle Release at Kannata Valley in 1989. N 50.79951 W 104.91324
Comments: 1995: Excellent site. Approximately 12 collections made. 1999: Phone survey. Beetles present. 2000: Good control on the warm side of the hill but beetles are not moving within 30' of water. 2002: Photo 2002 P5 - 016. 6/sweep in dense leafy spurge, control good down to a point near the water, in area near the water 1 Black Dot/sweep. 2003: Black Dot 100% Site photo. 2003 P6 - 014. GPS1 WP063.
Contact Person: Mike Mihal 731-3286 or John Mihal 731-2353

RM 219 Longlaketon NE 8-21-21 W2 SK-N-90-0062	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**5**	40 x 5	40	50	65.8	18.2	10
Monitored in 2000	**1 to 2**		5				
Monitored in 2002	**5 to 15**						
Monitored in 2003	**6 to 16**		11	48			

Black Dot Beetle Release in 1990 at Last Mountain House Park. N 50.77493 W 104.87224
Comments: 1995: Site is doing fair. Site has declined slightly since 1994. Beetles have spread north to patch on adjacent hill. In 1998, beetles were >20 per sweep. 1999: Phone survey. Not many beetles, little leafy spurge stand reduction. 2000: Site was grazed by 800 sheep for 24 days in 2000, starting on July 26. 2002: Sample site 5/sw, 15/sw. Photo 2002 P4 - 021, 022. Top of hill to the right Black Dot. 2003: 1st sample 6/sw, 2ond sample 7 - 16/sw. Black 95%. Photo 2003 P4 - 003. Photos area, site, patch before site (example of a collection area). 2003 P6 - 001, 002, 003. GPS1 WP068.
Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 219 Longlaketon NE 8-21-21 W2 SK-C-90-0017	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	unlimited	35	40	53.2	22.8	10
Monitored in 2000	**1**						
Monitored in 2002							

Brown Dot Beetle Release in 1990 at Last Mountain House Park. N 50.77493 W 104.87224

Comments: 1995: Site is doing well. Can be harvested in 1996. In 1998, beetles were >20 per sweep. 1999: Phone survey. Not many beetles, little leafy spurge stand reduction. 2000: Site was grazed by 800 sheep for 24 days in 2000, starting on July 26. The site is to the west of SK-N-90-0062, down the hill. It has no spurge, a good stand of grass, beetles did a good job. GPS1 WP068?.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 219 Last Mountain House NE 8-21-21 W2 AC-96-001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**0**		0				
Monitored in 2002	**>1**		0				
Monitored in 2003	**0**		0	0			

Brown Dot released in 1996. N 50.77506 W 104.87371

Comments: Nearest City: Craven. 2000: Site was grazed by 800 sheep for 24 days in 2000, starting on July 26. Could only find 3 small leafy spurge plants, a good grass stand. Assume beetles damage on a south facing slope. 2002: Release site, across creek 2-3 blacks/sw, closer to creek. Photo 2002 P4 - 023, 024, 025. Leafy spurge is controlled. 2003: West side of creek. Site, across creek, near creek, area. 2003 P6 - 010, 011, 012, 013. GPS1 WP069.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 219 Last Mountain House NE 8-21-21 W2 AC-96-002	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**1**		0				
Monitored in 2002	**5 to 6**		10				
Monitored in 2003	**7 and 30 - 35**		6	51			

Brown Dot released in 1996. N 50.77416 W 104.87321

Comments: Nearest City: Craven. 2000: Sheep did most of the damage on leafy spurge. Site was grazed by 800 sheep for 24 days in 2000, starting on July 26. 2002: Release site. Photo 2002 P5 - 001. 2003: Black 100%. Site photo 2003 P4 - 004, P6 - 004. GPS1 WP070.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 219 Last Mountain House NE 8-21-21 W2 AC-96-003	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	0						
Monitored in 2002	0		0				
Monitored in 2003	0		0	0			

Brown Dot released in 1996. N 50.77299 W 104.87368

Comments: Nearest City: Craven. 2000: Site was grazed by 800 sheep for 24 days in 2000, starting on July 26. Could not find any large leafy spurge plants, found 3 brown dots on general sweeps, upon further inspection found 2 small plants, 2-3 in. tall. 2002: Release site, west facing. Photo 2002 P5 - 003, 004. Leafy spurge controlled. 2003: East side of valley. Site photo. 2003 P4 - 006, 007 P6 - 006. GPS1 WP071.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 219 Last Mountain House NE 8-21-21 W2 AC-96-004	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	1		0				
Monitored in 2002	**3 to 4**		20				
Monitored in 2003	**6 and 15 - 16**		10	46			

Brown Dot released in 1996. N 50.77330 W 104.87335

Comments: Nearest City: Craven. 2000: Large spurge plants had their leaves stripped by sheep. Site was grazed by 800 sheep for 24 days in 2000, starting on July 26. 2002: Release area. Photo 2002 P5 - 002. 5 to 10% black. 2003: Black 90% and Black - Brown Dot 10%. Site photo. 2003 P4 - 005, P6 - 005. GPS1 WP072.

Contact Person: Rocky Coleman 787-1040; Landowner: SE

RM 219 Last Mountain House NW 18-21-21 W2 Number	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

Mostly Black and some Brown Dot released in 2000. N 50.7861 W 104.9029
Comments: 2000: 2500 beetles released on July 6.
Contact Person: Clark Brenzil 787-4673; Sam Small 731-2740

RM 220 McKillop NW 24-21-22 W2 Rapp3	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

1000 released on July 15, 2003 N 50.8043 W 104.9319 Cal
Comments:
Contact Person: Landowner: Ron Martin 731-3248

RM 220 McKillop NW 33-21-22 W2 SCWW wpt 58	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored ????							

Mostly black beetles released on August 8, 2000 N 50.83127 W 104.99358
Comments: 2000: West of house, along fenceline. Nearest town: Regina Beach. GPS2 WP321.
Contact Person: J. Oliver 535-9760 SWA; Landowner: Morley Alexander

RM 220 McKillop NW 33-21-22 W2 SCWW wpt 57	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored ????							

Mostly black beetles released on August 8, 2000 N 50.83160 W 104.99498
Comments: 2000: In hay field, west of house. Nearest town: Regina Beach. GPS2 WP322.
Contact Person: J. Oliver 535-9760 SWA; Landowner: Morley Alexander

RM 220 McKillop SK. Beach Lot5Bl.1 SK-C-88-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10**	unlimited	20	50			10

Brown Dot Beetle Release at Sask. Beach in 1988. N 50.8006 W 104.9491
Comments: 1995: Spurge reduced and beetles have moved from the original release area. Beetles numbers are not high but they have located throughout area. 1999: Phone survey. Number unknown, leafy spurge stand is reduced.
Contact Person: Alec Ferris 586-2828

RM 220 McKillop SE 27-21-22 W2 SK-N-88-0014	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**50 to 60**	180 x 310	45	45			10
Monitored in 2000	**2 to 12**		2				
Monitored in 2002	**7 to 11**		10				
Monitored in 2003	**3 to 11**		20	58			

Black Dot Beetle Release in 1988. N 50.80553 W 104.96861
Comments: 1995: Unable to check site in 1995 due to weather conditions, site was previously doing well. 1999: Phone survey. In 1997, beetles present but not plentiful. Minimal damage. 2000: A south facing slope. Very little leafy spurge in the area. When present leafy spurge is in the wetter areas or in woody brush cover. 2002: Photo 2002 P5 - 018. Beetle were found on the edge of the patch. 2003: Site photo (3/sw) and before site (11/sw). 2003 P6 - 016, 017. GPS1 WP056.
Contact Person: Russell Flavel 731-2985

RM 220 McKillop SE 27-21-22 W2 SK-C-89-0001	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**1 to 3**	20 x 40	30	55	51	20.5	5
Monitored in 2000	**5**		5				
Monitored in 2002	**3 to 14**		6				
Monitored in 2003	**1 to 2**		5	56			

Brown Dot Beetle Release in 1989. N 50.80611 W 104.96874

Comments: 1995: Unable to check site in 1995 due to poor weather conditions, site was doing OK previously. 1999: Phone survey. In 1997, beetles present but not plentiful. Minimal damage. 2000: A north facing slope. Leafy spurge is reduced on the north facing slope of the hill but leafy spurge is in the brush. 2002: Release area, 3/sw right of trees, 14/sw in front of photo. Photo 2002 P5 - 019. 2003: Site, by brush, 5 area photos 2003 P6 - 019, 020, 021, 022 (vigorous growing leafy spurge), 023, 024. GPS1 WP058.

Contact Person: Russell Flavel 731-2985

RM 220 McKillop SE 27-21-22 W2 SK-C-90-0020	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**1 to 10**	10 x 40	75	55	58.9	18.6	10
Monitored in 2000	**2 to 5**	several ac	4				
Monitored in 2002	**4 to 7**		4				
Monitored in 2003	**2 to 3**		8	48			

Brown Dot Beetle Release in 1990. N 50.80103 W 104.95330

Comments: 1995: Unable to check site due to poor weather conditions; site was questionable in 1994. 1999: Phone survey. In 1997, beetles present but not plentiful. Minimal damage. 2000: Leafy spurge reduced to a low level, beetles are still moving out from the original site. 2002: 7/sw near top of photo to right. Photo 2002 P5 - 017. 2003: Site photo 2003 P6 - 015. GPS1 WP055.

Contact Person: Russell Flavel 731-2985

RM 220 McKillop NW 23-21-22 W2 SK-C-91-0018	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**5 to 60**	55 x 400	45	50	55.7	17.9	5
Monitored in 2002	**2**		<1				
Monitored in 2003	**1**		1	46			

Brown Dot Beetle Release in 1991. N 50.980601 W 104.96894

Comments: 1995: Unable to check site due to poor weather conditions, site was considered excellent in 1994 with collections being made. 1999: Phone survey. In 1997, beetles present but not plentiful. Minimal damage. 2002: Release area, don't know if beetles controlled beetles on hill top, east view, valley to north. Photo 2002 P5 - 020, 021. 2003: Site photo. 2003 P6 - 018. GPS1 WP059.

Contact Person: Russell Flavel 731-2985

RM 222 Craik NE 15-21-28 W2 SK-C-91-0006	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10**	unlimited	40	45	63.4	15.9	5
Monitored in 1999	**2**		0	60	63.4	15.9	5

Brown Dot Beetle Release in 1991. N 50.78825 W 105.80072

Comments: 1995: Beetles found throughout area. Spurge is declining. 1999: Lots of beetles and leafy spurge vigour is reduced. Beetles are moving. GPS1 WP018.

Contact Person: Doug Patience 638-4967

RM 222 Craik NE 15-21-28 W2 SK-C-92-0017	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10**	unlimited	25	35			5
Monitored in 1999	**20**		3	60			

Brown Dot Beetle Release in 1992. N 50.78800 W 105.80061

Comments: 1995: Beetles found throughout area. Spurge is declining. 1999: Lots of beetles and leafy spurge vigour is reduced. Beetles are moving. GPS1 WP029.

Contact Person: Doug Patience 638-4967

RM 222 Craik NW 14-24-29 W2 Black Rel 1998	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1999	**2**	6	6	60			
Monitored in 2003	**3**		0	0			

Black Beetle released in 1998. N 51.04992 W 105.95052

Comments: Nearest town; Craik. 2003: Good LS control with goats. Black Dot, a few Blacks. Site photos. 2003 P10 - 017, 018. GPS1 WP030.

Contact Person: Doug Patience 638-4967; Landowner: Gerald Muirhead

RM 223 Huron SE 3-24-2 W3 Patience US1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**30**		15				
Monitored in 2003	**7 to 16**		6	43			

Mostly Black, some Black Dot released in 2001. N 51.01098 W 106.19580

Comments: 2002: Release site. Photo 2002 P6 - 016. Black Dot and a few Black established. 2003: Thinning out around release point. Black Dot. Site photo. 2003 P10 - 007. GPS2 WP341.

Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**15**		45				
Monitored in 2003	**4 to 6**		6	38			

Mostly Black, some Black Dot released in 2001. N 51.01101 W 106.19606

Comments: 2002: Release site. Photo 2002 P6 - 015. Black Dot and a few Black established. 2003: Center of site thinning out. Black Dot. Site photo. 2003 P10 - 008. GPS2 WP342.

Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US3	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**35**		15				
Monitored in 2003	**12**		9	48			

Mostly Black, some Black Dot released in 2001. N 51.01067 W 106.19571

Comments: 2002: Release site. Photo 2002 P6 - 014. Black Dot and a few Black established. 2003: Site thinned out. Black Dot. Site photo. 2003 P1 - 006. GPS2 WP343.

Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US4	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**25**		25				
Monitored in 2003	**18 to 19**		12	36			

Mostly Black, some Black Dot released in 2001. N 51.01073 W 106.19624

Comments: 2002: Release site. Photo 2002 P6 - 013. Black Dot and a few Black established. 2003: Black Dot. Site photo. 2003 P10 - 009. GPS2 WP344.

Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US5	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**15**		16				
Monitored in 2003	**4 to 7**		7	46			

Mostly Black, some Black Dot released in 2001. N 51.01074 W 106.19707

Comments: 2002: Release site. Photo 2002 P6 - 012. Black Dot and a few Black established. 2003: Black Dot, a few Black. Site photos. 2003 P10 - 010, 011. GPS2 WP345.

Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US6	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**20**		20				
Monitored in 2003	**5 to 7**		3	38			

Mostly Black, some Black Dot released in 2001. N 51.01079 W 106.19702
Comments: 2002: Release site. Photo 2002 P6 - 011. 75% Black Dot and 25% Black established. 2003: Black Dot, a few Black. Site photo. 2003 P10 - 012. GPS2 WP346.
Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US7	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**20**		15				
Monitored in 2003	**9**		12	56			

Mostly Black, some Black Dot released in 2001. N 51.01077 W 106.19745
Comments: 2002: Release site. Photo 2002 P6 - 010. Black Dot and a few Black established. 2003: Black Dot, a few Black. Site photo. 2003 P10 - 013. GPS2 WP347.
Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Patience US8	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**20**		9				
Monitored in 2003	**8 to 21**		8	51			

Mostly Black, some Black Dot released in 2001. N 51.01076 W 106.19773
Comments: 2002: Release site. Photo 2002 P6 - 009. Black Dot established. Some Black Beetles were found in a depression to the northeast. 2003: No woody plants in the 8 release sites. Black Dot, a few Black. Site photo, west, east, northwest. 2003 P10 - 014, 015, 016. GPS2 WP348.
Contact Person: Doug Patience 638-4967; Landowner: Dale Coutts 759-2516

RM 223 Huron SE 3-24-2 W3 Number	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

Black beetles released on July 9, 2001 N 51.0115 W 106.1919
Comments: There was a major release (48,000) to the north by Doug Patience during June 2001.
Contact Person: Dale Weisbrot 567-4400; Landowner: Dale Coutts 759-2516

RM 223 Huron NW 33-23-3 W3 SK-N-88-0011	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**3 to 5**	unlimited	30	40	94.2	3	10
Monitored in 2001	**1**		50	60			

Black dot release in 1988. N 50.99764 W 106.36691

Comments: 1995: Site doing well. Beetle numbers have slightly increased, and have spread extremely far. Beetles collected from this site in 1998. 1999: Phone survey. Lots of beetles and leafy spurge is reduced. 2001: Ants were found at the release site but not through the tress and up the hill. 3 beetles/sweep were found through the trees and up the hill. GPS1 WP137.

Contact Person: Reg Dolman 759-2398

RM 223 Huron SW 33-23-3 W3 SK-N-89-0011	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**3 to 5**	unlimited	30	50			
Monitored in 2001	**2**	10	50				

Black Dot Beetle Release in 1989. N 50.99696 W 106.36807

Comments: Beetles have moved over the hill and are doing well. Six collections made. Beetles collected from this site in 1998. 1999: Phone survey. Lots of beetles and leafy spurge is reduced. 2001: Leafy spurge is thinned, but some plant have set seed. GPS1 WP136.

Contact Person: Reg Dolman 759-2398

RM 223 Huron SE 3-24-2 W3 SK-N-89-0012	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**4 to 6**	3 x 5	65	75	94.5	3.8	
Monitored in 2001	**0**						

Black Dot Beetle Release in 1989. N 51.0115 W 106.1919

Comments: 1995: Spurge still quite dense however beetles were found predominantly southwest of the stake. 2001: Monitored by D. Patience. GPS1 WP225.

Contact Person: Dale Coutts 759-2516

RM 223 Huron SE 33-24-3 W3 SK-C-90-0028	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**3 to 5**	unlimited	50	55	65.5	18	
Monitored in 2001	**3 to 5**		25	70			

Brown Dot Beetle Release in 1990. N 50.99796 W 106.36446

Comments: 1995: Site doing fair. Site may be merging with 1988 Black Dot release. 1999: Phone survey. Lots of beetles and leafy spurge is reduced. 2001: Leafy spurge is thinned out but some plants flowered. GPS1 WP135.

Contact Person: Reg Dolman 759-2398

RM 223 Huron SE 34-22-3 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**3**		25	53			
Monitored in 2003	**1 to 3**		6	51			

Black Beetle released in 1998. N 50.91615 W 106.32451
Comments: Nearest town; Tugaske. 2001: Released by Reg Dolman, could not located the release point. 2003: Black Dot, a few Black. Beetles on the perimeter of the patch. Site photo. 2003 P10 - 005. GPS1 WP132.
Contact Person: Reg Dolman 759-2398; Landowner: Reg Dolman

RM 223 Huron SW 22-23-3 W3 1991-92 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**1 to 2**		20	55			

Br Dot Beetle released in 1991 or 1992. N 50.99534 W 106.36211
Comments: Nearest town; Tugaske. 2001: One of the original release sites. GPS1 WP163.
Contact Person: Reg Dolman 759-2398; Landowner: Reg Dolman

RM 223 Huron NW 22-23-3 W3 96 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**5**		20	60			

Black Beetle released in 1996. N 50.97559 W 106.34700
Comments: Nearest town; Tugaske. 2001: 90% Black and 10% Br Dot. GPS1 WP133.
Contact Person: Reg Dolman 759-2398; Landowner: Reg Dolman

RM 223 Huron NE 28-23-3 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**5**		20	50			

Black Beetle released in 1998. N 50.98771 W 106.35699
Comments: Nearest town; Tugaske. 2001: On the ridge from the road up from the valley. Reduced density, many shoots have seed heads. GPS1 WP134.
Contact Person: Reg Dolman 759-2398; Landowner: Reg Dolman

RM 223 Huron SE 34-23-3 W3 1996-98 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**2**		30	55			

Black Beetle released in 1996 or 1998. N 50.99873 W 106.32683
Comments: 2001: Some thinned out. GPS1 WP164.
Contact Person: Reg Dolman 759-2398; Landowner: Reg Dolman

RM 223 Huron SW 34-22-3 W3 ?	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	1		35	40			

Black Beetle released in 1998. N 50.91615 W 106.32451
Comments: Nearest town; Tugaske. 2001: Site has 70% black and 30% Br Dot. Thin out leafy spurge but some leafy spurge has seed heads. In 2001, a collection was made from this site. GPS1 WP132.
Contact Person: Landowner: Denis Brown

RM 231 Livingston NW 27-21-28 W3 Number	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

Mix of Black and Brown Dot released in 2000. N 50.8152 W 109.8033
Comments: 2000: 200 released on August 18.
Contact Person: Ed Gramlich 679-2339; Landowner: Brian Ourmus at Leader

RM 232 Deer Forks NW 28-20-29 W3 Number	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

Mix of Black and Brown Dot released in 2000. N 50.7278 W 109.9648
Comments: 2000: 200 released on August 18.
Contact Person: Ed Gramlich 679-2339; Landowner: Darren and Dean Mertes

RM 247 Kellross SE 16-26-14 W2 SK-C-92-0004	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**1 to 2**	2 x 4	55	65			

Brown Dot Beetle Release in 1992. N 51.2153 W 103.8898
Comments: Site not doing well likely due to presence of brush in area. 1999: Phone survey. site has not been visited for several years.
Contact Person: Robert Jorgensen 675-4423

RM 261 Chesterfield NW 14-24-29 W3 Number	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in ????							

500 black beetles released on July 11, 2001. N 51.0479 W 109.9482
Comments: Released 7 km west of Glen's ___ Vac Service, just east of main valley on Creek.
Contact Person: Richard Wharton 567-4406; Landowner: Gerald Muirhead 734-5100

RM 279 Mount Hope SW 22-28-20 W2 SK-N-88-0007	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**5**	5 x 5	45	50	80.5	11.5	

Black Dot Beetle Release in 1988. N 51.4044 W 104.7361

Comments: 13 collections were made from this site in 1994 and there was not allot of leafy spurge present. 1995: Moist conditions from a previous nights' rain may have been a contributing factor to the low beetle count. Spurge appeared to have thinned in areas which may be attributed to beetle activity. No collections were made in 1995.

Contact Person: Unable to contact Jim Down 524-2055

RM 344 Corman Park SW 2-36-6 W3 Mooney US1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**7 to 9**		2				
Monitored in 2003	**0**		0	0			

6000 Black Beetles released on June 22, 2001 N 52.05693 W 106.75735

Comments: 2002: Release site. Photo 2002 P4 - 012. 2003: Site sprayed with a herbicide. Black Dot. Site photo. 2003 P10 - 021. GPS1 WP123.

Contact Person: Garry Bowes, 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 2-36-6 W3 Mooney US2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**8 to 13**		5				
Monitored in 2003	**0 to 10**		1	30			

6000 Black Beetles released on June 22, 2001 N 52.05708 W 106.75740

Comments: 2002: Release site. Photo 2002 P4 - 013. Mostly black dots established. 2003: Beetles moved inside fence. 0/sw outside fence, 10/sw inside fence, 5 to 8/sw east by trees. Black Dot, a few Black. Site photo. 2003 P10 - 020. GPS1 WP124.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 2-36-6 W3 Mooney US3	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		16				
Monitored in 2003	**1**		0	13			

6000 Black Beetles released on June 22, 2001 N 52.05702 W 106.75764

Comments: 2002: Release site. Photo 2002 P4 - 011. Black dot established. 2003: Site mowed in early July. Black Dot. Site photo. Beetles on leafy spurge along the fence. Ants. 2003 P3 - 003, P10 - 019. GPS1 WP125.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 2-36-6 W3 Mooney US4	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**4 to 6**		12				
Monitored in 2003	**2 to 4**		0 to 4	10 to 28			

6000 Black Beetles released on June 22, 2001 N 52.05723 W 106.75776

Comments: 2002: Release site. Photo 2002 P4 - 014. Black dot established. 2003: Site mowed. Black Dot, a few Black. Site photo (2/sw by stake, 4/sw in nearest patch). 2003 P10 - 022. GPS1 WP126.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 2-36-6 W3 Mooney US5	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**<1**		10				
Monitored in 2003	**1 to 2**		1	18			

6000 Black Beetles released on June 22, 2001 N 52.05737 W 106.75813

Comments: 2002: Release site. Photo 2002 P4 - 015. Black dot established. 2003: Site mowed. Black Dot. Site photo. 2003 P10 - 023. GPS1 WP127.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 2-36-6 W3 Mooney US6	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**>1**		9				
Monitored in 2003	**1**		1	20			

6000 Black Beetles released on June 22, 2001 N 52.05724 W 106.75820

Comments: 2002: Release site, blacks established between stake and aspen. Photo 2002 P4 - 016, 017. Black dot established. 2003: Site mowed. Black Dot. Could not find Blacks near trees. Site photo. 2003 P10 - 024. GPS1 WP128.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 3-36-3 W3 Mooney US7	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		10	31			
Monitored in 2003	**1**		0	13			

6000 Black Beetles released on June 22, 2001 N 52.05740 W 106.77342

Comments: 2002: Black dots are establishing and black are not. Site photo. 2002 P4 - 005. 2003: Site mowed. Black Dot. Site photo. 2003 P10 - 025. GPS1 WP129.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SW 3-36-3 W3 Mooney US8	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		1 to 2	31			
Monitored in 2003	**2**		0	15			

6000 Black Beetles released on June 22, 2001 N 52.05749 W 106.77359

Comments: 2002: Site Photo, 2002 P4 - 006. Black dots are establishing and black are not. 2003: Site mowed. Black Dot. Site photos. 2003 P10 - 026, 027. GPS1 WP130.

Contact Person: Garry Bowes 933-7695, Neil Mooney 221-4013

RM 344 Corman Park SE 33-35-6 W3 SK-N-90-0058/C-91-0002	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1994	**1 to 2**	6 x 6	40	70	95.2	1.87	0
Monitored in 1999	**5**	300	50	46			
Monitored in 2000	**1 to 2**		20-30				
Monitored in 2001	**5**		12	35			
Monitored in 2002	**1 to 2**		0				
Monitored in 2003	**1**		0	15			

Black Dot Beetle Release in 1990 and Brown Dot in 1991. N 52.04812 W 106.78607

Comments: 1995: Could not locate release site in 1995. 1997: The beetles are not doing very well. 1999: Field was mowed so difficult to evaluate. Sampled a few non-mowed areas. Beetles are all over, spurge density is thinned but not to the desired density. 2000: Beetles are all over the 40ac field in low numbers. In places spurge is thinned, not grazed so a thick litter layer. 2001: Land owned by Mr. and Mrs. Thrasher. Site grazed by sheep. Leafy spurge is thinned out, but there are some seed heads on leafy spurge. 2002: Mostly black dots. Site grazed by sheep. 2003: June 13, no sheep. 2003 P1 - 007. July 15 sheep on leafy spurge. 2003 P4 - 001. August 6 sheep grazed. Black Dot. Site photo. 2003 P12 - 004. GPS1 WP143.

Contact Person: Ed Morgan 382-0145

RM 344 Corman Park SW 34-35-6 W3 SK-C-92-0003	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**<1**	n/a	50	33			0

Brown Dot Beetle Release in 1992. N 52.0446 W 106.7794

Comments: 1995: Site not doing well. Failure could be due to excessive moisture. Site is located in an area that is not well drained. Monitored on cloudy day following heavy rains. In 1997, the beetles are not doing very well. 2001: Did not establish, housing development.

Contact Person: Ed Morgan 382-0145

RM 344 Corman Park NE 12-35-6 W3 Morgan Rel 1998.	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**15**		10	40			
Monitored in 2002	**12**		1 to 4				
Monitored in 2003	**18 to 19**		6	36			

Black Beetle released in 1998. N 51.9922 W 106.7190

Comments: Nearest town; Saskatoon. 2001: A few beetles were found in the grass clearing in the bush, two ant hills between release point and clearing. Leafy spurge is thinned out, but some plants have seed heads. 2002: Site, 5/sw field edge, 12/sw grassland, 3/sw into opening. Photo 2002 P4 - 009, 010. 2003: LS growing with wolfwillow. Black, very few Black Dot. 2003 P12 - 007, 008, 009. GPS1 WP045.

Contact Person: Landowner: Ed Morgan 382-0145

RM 344 Corman Park SW 4-36-6 W3 Bowes Rel 1999	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2000	**0**		20				
Monitored in 2001	**0**						
Monitored in 2002	**1 to 2**		25	36			
Monitored in 2003							

Black Beetle released in 1999 N 52.05562 W 106.80747

Comments: Released behind the old house, up the hill and over by the piece of chrome. Sandy area. 2001: Site is dune sand, leafy spurge beetles did not establish. 2002: Photo 2002 P4 - 004. No blacks but 1 to 2 black dots from an unknown population. 2003: Site destroyed, off road radio control club. Construction removed plant top growth. GPS1 WP044.

Contact Person: Garry Bowes 933-7695

RM 344 Corman Park SE 33-35-6 W3 Bowes Rel 2000	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**>1**		20	40			
Monitored in 2002	**1 to 2**		0				
Monitored in 2003	**1**		0	10			

Black Beetles released in 2000. N 52.04716 W 106.78547

Comments: 2000: Land owned by Mr. And Mrs. Thrasher. In a 40 ac pasture, not grazed. 2002: Sheep grazed site with black dot beetles, not blacks established, grazed leafy spurge close up. Photo 2002 P4 - 007, 008. Blacks failed to establish, black dots had established and remain. Site grazed by sheep in 2001 and 2002. 2003: Grazed by sheep. Black Dot. Site photos. 2003 P12 - 001, 002, 003. GPS1 WP142.

Contact Person:

RM 345 Vanscoy SE 12-35-7 W3 SK-N-91-0004	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	35 x 10	25	20	94.7	2.82	10
Monitored in 1999	**10**		15				
Monitored in 2000	**5 to 7**	30	20				
Monitored in 2002	**4 to 8**		5				
Monitored in 2003	**1 to 3**		2	18			

Black Dot Beetle Release in 1991. N 51.99086 W 106.86586

Comments: 1995: Site is doing extremely well. Approximately 6 collections made. Lots of beetles near the release site, they have moved in small numbers. Leafy spurge is reduced but still at a relatively high density. 2002: Release area. Photo 2002 P4 - 018. 2003: Site mowed. Black Dot, few Blacks on North side of road. 2003 P12 - 005, 006. GPS1 WP042.

Contact Person: Don Kinzie 668-4416

RM 406 Mayfield SW 12-41-12 W3 SK-N-90-0060	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**3**	10 x 15	20	30	70	15.2	0

Black Dot Beetle Release in 1990. N 52.5103 W 107.6013

Comments: 1995: Moderate site. Pasture heavily grazed. 1999: Phone survey. The site is fenced off and is now a sheep pasture. 2001: Site not found.

Contact Person: Richard Clayton 389-2183

RM 438 Battle River NW 19-43-16 W3 98 Release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**<1**		10	55			
Monitored in 2002	**1**		25				
Monitored in 2003	**2 to 3**		4	30			

Black released in 1998. N 52.71812 W 108.31214

Comments: Site located before the bridge to the right of the 3 power poles. Some leafy spurge appears to be thinned out. 2002: Release site. Photo 2002 P7 - 007, 008, 009. Site mowed, very rough for mower, mower missed. 2003: After a rain. 90% Black Dot and 10% Black. Site, close up, area (field, ROW). 2003 P12 - 015, 016, 017. GPS1 WP141.

Contact Person: Bryan Doig 446-7477, Karen Benjaminson 446-4050

RM 438 Battleford SW 29-43-16 W3 Multiple Releases	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2001	**1 to 5**		1 to 8	35			
Monitored in 2002	**1 to 2**		5				
Monitored in 2003	**7**		10	51			

Br Dot released on ??? N 52.73181 W 108.29676

Comments: 2001: 1 to 5/sweep behind the houses, 1/sweep at the release site on the hill. The release site is thinned out. 2002: Release area Photo 2002 P7 - 005, 006. Black Dot and some Black. 2003: Top hill 70% Black Dot 30% Black, Mid 80% Black and 20% Black Dot. Site photo 2003 P12 - 014. GPS1 WP140.

Contact Person: Bryan Doig 446-7477

RM 438 Prairie NE 33-42-16 W3 SK-C-92-0012	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**10**	20 x 40	40	35			

Brown Dot Beetle Release in 1992. N 52.6631 W 108.2368

Comments: Site doing fair, beetles have spread from release point and area shows insect damage. 1999: Phone survey. In 1977, the beetles were present and have thinned out the spurge. 2001: Unable to get to site.

Contact Person: Roland Radchenko 937-2704

RM 438 Battle River SW 17-43-16 W3 SK-N-88-0008	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**7 to 10**	unlimited	40	60	86	6.6	
Monitored in 2001	**1 to 2**		20	50			

Black Dot Beetle Release in 1988. N 52.69345 W 108.29646

Comments: 1995: Beetle numbers increased slightly from 1994. Beetles present throughout spurge, site likely has merged with the 1989 black dot release. 4 collections made up to 1995. 1999: Phone survey. Beetles present and reduced leafy spurge at release site. 2001: Scholastic site, now Highridge Bison Range Ltd owned by Ray Blais 937-7115. 5 Beetles/sweep in hot spots. Leafy spurge is thinned but a few plants set seed. GPS1 WP168.

Contact Person:

RM 438 Battle River SE 17-43-16 W3 Not a release	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1**		8				
Monitored in 2003	**1 to 3**		3	43			

N 52.70204 W 108.25722

Comments: 2002: Photo 2002 P7 - 010. Not a know release site. Black Dot established along a road ROW that was sprayed. Beetles are on leafy spurge growing in the fenceline. 2003: After a rain. Black Dot. Site photo, close up. 2003 P12 - 018, 019. GPS1 WP214.

Contact Person:

RM 438 Battle River SW 8-43-16 W3 SK-N-89-0022	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**8**	unlimited	35	60	86	6.6	
Monitored in 2001	**1**						

Black Dot Beetle Release in 1989. N 52.69845 W 108.29646

Comments: 1995: Site doing well, has merged with 1988 black dot release. 3 collections made. 1999: Phone survey. Beetles present and reduced leafy spurge at release site. 2001: Scholastic site, now Highridge Bison Range Ltd owned by Ray Blais 937-7115. GPS1 WP168.

Contact Person:

RM 438 Battle River SW 17-43-16 W3 SK-C-91-0015	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**2 to 5**	10 x 10	50	75			
Monitored in 2001	**1**		20	46			

Brown Dot Beetle Release in 1991. N 52.70332 W 108.29561

Comments: 1995: Site has improved slightly, zone of influence clearly visible. 1999: Phone survey. Beetles present and reduced leafy spurge at release site. 2001: Scholastic site, now Highridge Bison Range Ltd owned by Ray Blais 937-7115. Leafy spurge is thinned and some has set seed. Beetles were found over all of the pasture and along #4 Highway. The shoulder of #4 highway was sprayed for leafy spurge for 3 years, 1999, 2000 and 2001, and the beetles are doing fine on the sprayed site. GPS1 WP169.

Contact Person:

RM 442 Manitou Lake SW 16-44-27 W3 SK-N-88-0012	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**4 to 6**	70 x 70	55	50	90+		

Black Dot Beetle Release in 1988. N 52.7867 W 109.8628

Comments: 1995: Site doing fair. Beetles cover entire spurge area. Site marked with stake and surveyor's tape. 1999: Phone survey. Site sprayed with Roundup and now farmed, beetles move 1/4 mile away and are doing well.

Contact Person: Jim Gray 826-5623

RM 442 Manitou Lake NW 11-44-27 W3 SK-C-90-0068	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**15**	50 x 80	45	40	93.1	3.94	

Brown Dot Beetle Release in 1990. N 52.7794 W 109.8145

Comments: 1995: Site located in a cow graveyard. Site doing quite well. 5 collections made. 1999: Phone survey. Beetles present, some leafy spurge damage.

Contact Person: Brian McIntyre 826-5516

RM 463 Duck Lake SE 19-44-2 W3 SK-N-89-0018	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	30 x 25	5 to 10	20	87	6	10

Black Dot Beetle Release in 1989. N 52.8485 W 106.2739
Comments: 1995: Excellent site. Harvestable in 1996.
Contact Person: Brian Seesaquasis 467-4760 or 467-4523: Landowner: Beardy's Reserve

RM 463 Duck Lake Farmer Released	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 1995	**>20**	33 x 28	3 to 4	20			10

Brown Dot Beetle Release in 1990 From Maxim.
Comments: 1995: Excellent site. Harvestable in 1996.
Contact Person: Unknown

RM 464 Leask NW 24-47-5 W3 Peake1	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**1 to 2**		4 to 10				
Monitored in 2003	**2 to 3**		4	41			

3000 Br Dot Beetles released on July 19,2001. N 53.06804 W 106.60788
Comments: Nearest town: Kilwinning. 2001: A grazed pasture but the cattle are not grazing the selected area. 2002: Release site. Photo 2002 P4 - 019, P7 - 001, 002. Photo 2002 P4 - 019. 2003: Almost raining. Site photo. 2003 P12 - 010 (toadflax), 012. GPS1 WP166.
Contact Person: Landowner: Ron Peake 466-4656

RM 464 Leask NW 24-47-5 W3 Peake2	**No. of Beetles / Sweep**	Beetle Diameter (m)	No. of Flowering Stems / m2	Height of Leafy Spurge (cm)	%Sand	%Clay	% Bare Ground
Monitored in 2002	**<1**		0				
Monitored in 2003	**<1**		25	36			

9000 Br Dot (70%) & black (30%) Beetles released July 26, 2001. N 53.06810 W 106.60673
Comments: 2001: Release at the edge of a patch of leafy spurge where cattle graze. 2002: Release site. Photo 2002 P4 - 020, P7 - 003, 004. Black dots establishing. 2003: Almost raining. Black Dot. 2003 P12 - 012, 013. GPS1 WP167.
Contact Person: Garry Bowes 933-7695: Landowner: Ron Peake 466-4656

2004 Scentless Chamomile

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[1] Financial support for The Noxious Weed Program has been provided by the Canadian Adaptation and Rural Development Fund in Saskatchewan (CARDS) and Agriculture Development Fund (ADF) to Saskatchewan Association of Rural Municipalities (SARM) in collaboration with Saskatchewan Agriculture, Food and Rural Revitalization (SAFRR). Funding for the CARDS Program is provided by Agriculture and Agri-Food Canada.

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Canada SARM CARDS Saskatchewan Agriculture, Food and Rural Revitalization

Dear Colleague

This report contains recent information on the use of biological control agents to control scentless chamomile. This includes information on agent establishment and collection methods.

The text is updated, modified and reformatted from a previous publication, the Integrated Biocontrol Strategies for Noxious Weeds, Field Reference Manual by Brad Thompson. Photographs from the original publication are not included in this report. Addition information is included from leaflets supplied by Dr. A. McClay of the Alberta Research Council and the research article in Biological Control 14: 85-95 (1999).

As you read this report you will find that agents used on scentless chamomile have a different 'life style', compared to agents used for the control of leafy spurge. Scentless chamomile biological control agents are more mobile and quickly disperse from the release site. Therefore, they are harder to find when monitoring after a release.

If you have any comments on this report, please forward them to the author. Also, if you have time to monitor a site, please copy the appropriate monitoring form from this report and forward it to the author.

Best wishes,

Garry Bowes
Coordinator
Noxious Weed Program
3830 Thatcher Avenue
Saskatoon, SK
S7K 2H6

Telephone: 933-7695
Facsimile: 933-7352
e-mail: gbowes@agr.gov.sk.ca

Scentless Chamomile[2]

Identification

Scientific name: *Tripleurospermum perforatum (Merat) Lainz* (*Matricaria perforata* Merat)
Other common names: wild daisy, false chamomile, or barnyard daisy
Origin: Eurasia

Description

Flower The flowers of scentless chamomile are 2-4 cm in diameter and have white petals with central yellow disk florets. Their appearance is similar to a daisy. Flowers appear between June and September.

Stem & Leaves The stem is erect reaching heights of 15-100 cm. It is dark green in colour but is occasionally streaked red. The stem is multi-branched with fine dissected leaves.

Roots The fibrous roots of scentless chamomile may bind soil in to large clumps after cultivation and when pulled. This enhances weed survival.

Reproduction This plant reproduces by seed. It is a prolific seed-producer. An over wintering plant can produce up to one million seeds in a single season. Normally the upper limit is 300,000 seeds per plant. Seed development is continuous throughout the summer. Therefore, at any one time the plant may contain immature flowers, seed heads, and mature seed. The seeds, also known as *achenes*, are dark brown or black with three distinctive light-brown ribs. They are approximately 2 mm in length. The seeds are spread by human activity, wind on crusted snow and water.

Life Cycle Scentless chamomile plants can either be an annual, winter annual or short-lived perennial depending on the time of germination. Seeds begin to germinate in the spring and can continue to germinate during the summer. Flowering can commence as early as 58 days alter germination. Early flowering scentless chamomile plants can be perennial and produce flowers and seeds all season long. Seeds, which germinate before mid-July, will produce a plant that flowers within the growing season. Seeds, which germinate after mid-July, will demonstrate the winter annual growth form. Winter annual plants remain vegetative for the remainder of the summer and over winter as rosettes. Next spring, the plant bolts and initiates flowering early in the season.

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[2] This text is modified from the Integrated Biocontrol Strategies for Noxious Weeds, Field Reference Manual by Brad Thompson, available from Saskatchewan Agriculture, Food and Rural Revitalization. Photographs are not included. Information is added from leaflets supplied by Dr. A. McClay of the Alberta Research Council and a research article in Biological Control 14, 85-95 (1999).

Habitat Scentless chamomile grows in moist, disturbed areas such as roadsides, slough margins and farmyards. Preferred areas of growth are often at the edge between two habitats. Germination can occur after occasional spring floods, which provides a strong competitive advantage for establishment around sloughs and other low-lying areas. Once established in these areas, the sheer number of seeds released will facilitate the spread of scentless chamomile into cultivated fields.

Impact Scentless chamomile reduces yields in cereal, pulse, forage and oilseed crops. For example, 25 over wintered scentless chamomile plants/m^2 decreased spring wheat yield by 20%-60%. Higher yield losses occur in wetter than normal years.

Comments Scentless chamomile may be mistaken for other plant species such as wild chamomile, pineapple weed, or ox-eye daisy. The easiest way to differentiate scentless chamomile from either pineapple weed or wild chamomile is to look at the mature flowers. Pineapple weed flowers do not have the outer ring of white florets. In wild chamomile, the yellow centre is conical in shape, whereas in scentless chamomile it is much more rounded. Another way to differentiate scentless chamomile from similar plants is to grind the flower head. Both wild chamomile and pineapple weed have a characteristic pineapple-like odour, scentless chamomile, as the name implies, does not have this odour. Comparing the leaves of scentless chamomile and ox-eye daisy is the easiest way to tell the two species apart. Ox-eye daisy leaves are broad and coarsely toothed in comparison to the finely divided leaves of scentless chamomile.

Biological Control Agents

Biological Control Agent Profile:
Scentless Chamomile Seed Weevil
Omphalapion hookeri

The first release of seed weevils in Canada was in 1993. Seed weevils are approximately 2 mm long and are a shiny black colour.

Their life cycle begins in the spring (as early as the end of April) when over wintered adults emerge from the leaf litter or soil. Once emerged, the seed weevils feed on the leaves of chamomile plants. This continues until flower buds form on the plants. The females will then move up the plant and deposit eggs in a bud when the white ray florets start to develop. The process of feeding and egg lying by the adults continues until late July. The developing larvae feed on immature seeds in the flower head. When the larvae finish feeding, they pupate in the flower heads. New adults emerge from the seed heads in August, and depending on the timing, may begin feeding on the plants. By late summer newly emerged adults will move into the leaf litter or soil and over winter, thereby completing the cycle. There is one generation per year.

How the Seed Weevil Stresses Scentless Chamomile

Reduced seed production is the primary mode of control exerted by the seed weevil. Defoliation is not sufficient to stress scentless chamomile. At the Vegreville test site each larvae eats about 11 seeds. A scentless chamomile seed head has about 171 seeds/head. After four years, there was an average of three seed weevils per flower head. The maximum number of seed weevils was 17 in a seed head collect near Canwood, Saskatchewan. On average, four years after a release, 40% of the seed heads contained a seed weevil.

Seed weevils tend to disperse rapidly from the release point and are thinly spread over large areas. Seed weevils spread about 15 km in 10 yrs. The population of the seed weevil is still increasing in Saskatchewan.

Success of Past Releases

In western Canada, 74% of the seed weevil releases have been successful. In a year, a seed weevil population has increased 17-fold and in rearing cages, net reproduction rates increased up to 64-fold.

Habitat and Climate Limitations

Habitat and climate factors do not appear to limited seed weevil establishment. Many infestations of scentless chamomile occur near sloughs or low-lying areas. Seed weevils have established on scentless chamomile plants growing in wet to marshy areas.

Why Release Sites Fail

Site failure is associated with environmental changes or human activities such as drought, mowing, construction, herbicide spraying and trampling by cattle.

Selecting a Release Site

Choosing a suitable site for release will greatly increase seed weevil establishment. When selecting a release site, try to meet the following criteria.

1) After release, do not disturb a release site. Do not apply herbicides, till or mow a new site. In addition, the site should receive little to no grazing until the insects establish a stable population. Try to protect the site for at least five years.

2) A site should be large enough to support a developed seed weevil population. Because seed weevils disperse, they will first thinly populate all the scentless chamomile plants over an area. If the scentless chamomile

infestation in the release area is large, then the seed weevil will slowly populate the area. Once an area is thinly populated, the seed weevil population will increase to an unknown number.

Collection for Initial Release

Collect scentless chamomile seed weevils only from sites where the seed weevil has successfully established itself.

Before collection for a release, it is essential to know the extent of the seed weevil establishment within a site to avoid collection of uninfested seed heads. To determine the average number of adult seed weevils per seed head at the collection site, use a pair of sharp scissors or a knife to harvest a 100 mature seed heads and place them in a container. Dissect each of the seed heads and count the number of adults present in each head. **A site is suitable for collection when the seed weevils are present in over 50% of 100 randomly sampled seed heads. Timing for collection is from the last week in July until the end of August.**

A good site can average three adult seed weevils per seed head. At the Alberta Research Council's test site at Vegreville, it took four years for the released seed weevil population to increase to three seed weevils per seed head. Remember to save any extracted adults from the dissections because they can form the basis of a release colony.

Release the seed weevils either in the spring/early summer or in the late summer/fall.

For **spring/early summer releases** store the seed weevils over winter. In the late summer/fall, collect seed heads with seed weevils from a site where the insect has established. Before the seed weevils are stored over winter, allow the adults to feed for 2 - 3 weeks on scentless chamomile. Collect the seed weevils and store them in plastic containers. Place this container in a large pail, which is filled with one-half inch of water, and keep at 0^0 C over winter. The seed weevils in the container should not be exposed to the water in the pail. When scentless chamomile comes into the bud stage in the spring, place the seed weevils in the field. Release sites should have a vigorous stand of scentless chamomile with plenty of flower buds. A release of 60 - 100 seed weevils is sufficient for successful establishment. The seed weevil has established following a release of 30 adults in the spring.

A release of 200 - 500 adult seed weevils is required to establish a site in the **late summer/fall**. Releasing a larger number of seed weevils will increase your chance for a successful establishment.

Choose one of the following methods to capture the seed weevils from seed heads.

Aspirator Method Spread the seed heads out in a large tray. When the seed weevils emerge, collect them with an aspirator. This is the most accurate method for collecting a sufficient number of seed weevils for release. However, this method is very time consuming, as the tray cannot be left unsupervised because the adults will escape. Secondly, aspirators and/or trays suitable for containing the emerging seed weevils may not be available.

Direct Distribution An alternative method is to distribute the collected seed heads at the release site, allowing the seed weevils to emerge on-site. The drawbacks associated with this method are that the actual number of adult seed weevils released will be unknown. The second drawback is that this method is slightly more sensitive to weather conditions 24 hours after release. Cool or wet conditions after a release will have a negative impact on the viability of the release population, as adults will not be as likely to emerge and may eventually die in the seed head.

Regardless of the release option selected, release the seed weevils as soon as possible after they are collected. If this is not possible due to weather conditions or travel, the insects can be stored in a cooler with ice packs, or in a fridge. Under these conditions, it is critical that the temperature does not fall below 4^0 C at any time during storage.

Mass Rearing

Seed weevils can be reared quite easily on potted scentless chamomile plants. In the spring, travel to a site, which has vigorously growing scentless chamomile plants. Select large over wintered plants in the rosette stage and put, one plant per pot, in 12-inch diameter pots. Move the potted plants to an appropriate site for timely watering, and fertilizing to promote rapid growth and plenty of flowers. The plants can be kept in a screened cage out doors or in a shelter location outdoors without screening. When the buds appear, put some seed weevils on the scentless chamomile plants. One large healthy scentless chamomile plant can easily accommodate 100 adult seed weevils. Obtain the seed weevils from a site where they have previously established or use stored over wintered seed weevils.

Establishing a Release Site

Equipment Needed:

When releasing seed weevils, you will need the following equipment:

- stake
- sledge hammer
- camera

- pen and paper
- $^1/_4$ m^2 quadrat
- GPS equipment

Stake and photograph the release site for future reference. Use a $^1/_4$-m^2 quadrat to sample the density of scentless chamomile. It is highly desirable to obtain a GPS reading for a release site.

Ambient temperature is an important factor to consider when making a release. Temperatures above 28^{0}C can dramatically increase mortality; therefore transport the seed weevils to the release site in a cooler with ice packs. Conversely, cool temperatures (<18^{0}C) are not beneficial for a release, as the seed weevils will not be sufficiently active.

Selecting the Release Point

Although many scentless chamomile infestations are located near sloughs or low-lying areas, keep release sites away from areas that are expected to flood in the spring. Give the seed weevils the best opportunity that you can to establish. Spring run-off can drown over-wintering adults when a release is too close to sloughs or low-lying areas. Secondly, do not release seed weevils near anthills or wasp nests. Ants and wasps are enemies of seed weevils

Making the Release

Released the insects in the centre of the stand and mark the location with a clearly visible stake. To release the insects, place the opened shipping container on the ground near the stake and leave undisturbed for 10-15 minutes. This allows the insects to adjust to their new environment (particularly important if they were in a fridge or a chilled cooler immediately before release). Allow the insects to exit the container. Gently shake the remaining insects out within 1-3 metres of the stake. This distribution lessens the risk of mortality from predacious insects. Finally, complete a release record sheet. If you do not have a copy of a release form, photocopy the example in this document.

The release record sheet used by Saskatchewan Agriculture, Food and Rural Revitalization is included in this document. Information on site characteristics is important to determine insect establishment and to assess the effect seed weevils will have on scentless chamomile. Use a $^1/_4$ m2 quadrat to sample the number of flowering stems per square meter.

This information is essential to determine the appropriate conditions for a successful seed weevil biological control site. Sharing the pooled release data benefits all biological control participants in the long term.

Assessment of Scentless Chamomile Seed Weevil Establishment: Annual Site Evaluation

Monitoring Protocols

It is important to follow up seed weevil releases on an annual basis to record the degree of seed weevil establishment. Saskatchewan Agriculture, Food and Rural Revitalization uses this data to make better recommendation for future release and insect handling procedures. Seed weevil sites require two follow-up visits per year.

Presence or Absence of Adults

The first visit should occur on a warm sunny day in late June or early July. The purposes of this visit are to verify that adults have emerged from the leaf litter, and to obtain a rough estimate of the number of seed weevils present. Complete the form, 'Seed Weevil (*Omphalapion hookeri*) Field Data Sheet 1: Presence or Absence', to ensure all of the necessary information is collected. If you do not have this form, then print and photocopy the form, which is available in this document.

The site and sampling data sections are self-explanatory; weather conditions apply to the weather on the sampling day and, if applicable, the night before (i.e. if it had rained). Weather conditions have a major effect on the number of insects found at any one time. Therefore, knowing this is important in determining the difference between a poorly performing site and a good site evaluated on a poor day. For the insect density estimate, the best procedure is to start 5-10 meters away from the release point and begin to carefully circle toward your release point, visually inspecting the plants for seed weevils as you move closer. Shiny black seed weevils on the flower buds of scentless chamomile plants should be obvious. Set your watch to determine the number of adults that you can find in 30 minutes. Record the results. If adults are not found after 30 minutes then record zero. For this level of monitoring you should not need longer than 45 minutes per site to evaluate a site. The miscellaneous information section on the data sheet pertains to other relevant information. Examples of this type of information include a late frost, an intense hailstorm, possible pesticide drift or information on any event that may have affected the insect or the scentless chamomile population. This information is helpful in determining why a site may have failed. For example, adverse environmental conditions could eliminate a population in its early stage of development even though site selection and insect release were optimal.

Scentless Chamomile Stand Assessment

The second visit to the release site should occur in mid to late August when the scentless chamomile seed heads are beginning to ripen but before seed dispersal. The methodology used for this visit depends on the results of the June/July visit. If the June/July visit detected adults, assess the site for damage, using the 'Seed Weevil (*Omphalapion hookeri*) Field Data Sheet 2: Scentless Chamomile Assessment sheet', included in this document. If the June/July visit detected no adults, then sample the seed heads to obtain a more accurate estimate of the level of seed weevil establishment. If seed weevils are present at the site, then filled out the Seed Weevil Field Data Sheet 2. If no evidence of seed weevils or seed weevil presence is found in the seed heads then nothing further should be done until the following June. The next year, the process should be repeated (both site visits performed) to determine if seed weevils are present. If you are unable to find seed weevils in the following year, then consider the seed weevil establishment unsuccessful.

Sampling for seed weevil larvae or pupae in the seed heads consists of randomly removing approximately 200 seed heads from within 10 meters of the release point. Package the heads into a clean, dry container and label with the release reference number. Then take the seed heads to a laboratory or any other location suitable for seed head dissected. Seed heads are dissected to determine the number and the developmental stage of seed weevils found (a magnifying glass or dissecting scope may be helpful for this). In seed heads where the adults have emerged, simply count the vacated cells. For further information, please contact:

Dr. Rose DeClerke-Floate
Weed Biological control
Agriculture and Agri-Food Canada Research Centre
Corner of Highway 3 & 43rd Ave.
Lethbridge, Alberta T1J 4B1
(403) 327-4561

The purpose of the second field data sheet is to assess the effect of the seed weevil on the general vigour of the scentless chamomile infestation. The format of the form matches the format and content of the release form to allow for easy comparison. The nature of the seed weevil is such that it does not significantly stress the scentless chamomile plant but serves to reduce its reproductive capability.

When to Harvest for Redistribution

Collection at a site for redistribution can commence when seed weevils infest 50% of a random sample of 100 mature seed heads. It may take at least five years for seed weevils to infest 50% of the seed heads. Exercise caution when initiating a collection for redistribution, because the removal of too many mature adults may adversely affect seed weevil establishment the following year. Infestation rates in successful locations should be significantly higher than 50%. In Nova Scotia, typically exhibit infestation rates range between 85-95%. It is too early to tell what seed weevil infestation rates can be expected in Saskatchewan.

Biological Control Agent Profile:
Scentless Chamomile Stem Weevil
Microplontus edentulus

Biology

This weevil lays eggs in the upper parts of stems of bolted scentless chamomile plants. The adults are about 3 mm in length, mottled grey, and have a distinctive whitish "arrow" marking on the back, pointing towards the head. The larvae feed inside the stems, and will tunnel up the branches into the bases of the flower heads. In late summer, the mature larvae cut an exit hole in the stem, crawl out of the stems and drop into the soil, where they quickly burrow into the soil. In the soil, the stem weevils pupate and over winter. In the spring over wintered adults emerge from the soil. There is one generation per year.

Current Status

In 1997, Plant Health and Production Division of the Canadian Food Inspection Agency approved the release of the scentless chamomile stem weevil in Canada. Dr. Alec McClay at the Alberta Research Council (ARC) at Vegreville developed a rearing method for the insect and they are maintaining a breeding colony. Rearing is more labour-intensive than for the seed weevil (*O. hookeri*), and the insects are still in short supply.

ARC released the stem weevil at several sites in British Columbia, Alberta, Saskatchewan, and Manitoba. The good news is that, as of May 1999, ARC has confirmed that the stem weevil has survived for two years on research plots at Vegreville, when the scentless chamomile plants infested with the stem weevil were transplanted into a field. Establishment has not yet been detected at any of the other release sites in Saskatchewan, unless a release was made under a fine-mesh screen cage. The adults are quite good fliers and they will dispersed quickly from the release sites. Thus, even if they are established and breeding at these sites, they may not have shown up in the limited stem samples collected around the release points.

How the Stem Weevil Attacks Scentless Chamomile

At the site where the stem weevil was released in transplanted plants, adults and attacked stems were found the first and second year after release. Stem weevils eat the interior of the scentless chamomile stems, leaving hollow areas or 'mines'. Two years after release, 62% of the stems, located 100 metres from the release point, showed mining activity by the stem weevil larvae. There were two mines per attached stem.

In potted scentless chamomile plants, the stem weevil has reduced the number of stems and flower heads of the noxious weed. This has not been demonstrated under field conditions in Canada.

Release

Once stem weevils are available, ARC suggests that we use the following procedure when releasing the insect. To make it easier to detect establishment of the insect, ARC suggests that adults should be released under fine-mesh screen cages. ARC has some small field cages available (1 m x 1 m x 1 m) that could be loaned to co-operators. If requested, these will be shipped out to co-operators at the same time as the insects. The cage should be set up over a dense, vigorous patch of scentless chamomile, which is producing plenty of thick flowering stems. Release the weevils into the cage, which is then left in place for 2 weeks. The cage should then be removed from the release point and shipped back to ARC. The weevils should then disperse from the cage and infest plants over a larger area. Using this procedure, it will be possible to determine whether the stem weevils have been breeding on the plants in the caged area.

Monitoring

Adult stem weevils may be difficult to find during the first few years after a release because they move around well and they thinly populate a release area.

Dr. Alec McClay would like to get samples from all 1997 - 2001 release sites so that ARC can check for signs of establishment. There are only six release sites in Saskatchewan. We plan to collect stem samples from the release sites in late August. This should be late enough to ensure that the larvae have already exited from the stems, so that sampling will not have an impact on the existing population of the stem weevil. The empty tunnels in any stems attacked by stem weevil will still be quite evident. For an open site, collect 50 tall, well-grown stems from around the release site. If the release was caged, then collect 25 from inside the cage area and 25 outside, and label them separately. Strip off most leaves, flowers and seed heads from the stems, so that the stems will last longer in shipment. Place the stem sample in a large plastic bag, loosely closed so that some humidity can escape from it, and then in a cardboard box.

Send stem samples by courier to:
Dr. Alec McClay
Crop and Plant Management
Alberta Research Council
PO Bag 4000
Vegreville, AB T9C 1T4
Tel.: 780-632-8207
Fax: 780-632-8612
E-mail: alec@arc.ab.ca.

Dr. Alec McClay will dissect all stems and check for attack by *M. edentulus*.

Biological Control Agent Profile:
Scentless Chamomile Gall Midge
Rhopalomyia tripleurospermi

Biology

Adult scentless chamomile gall midges are tiny, delicate flies, which live only for a few hours. The females lay eggs in the growing points of scentless chamomile plants. Larvae hatch out from these and feed in the meristematic tissue, causing it to swell into a gall. The gall is visible as a mass of short crowded leaf-like growths, with a "mossy" appearance. Galls can be induced in the growing tips of rosettes and bolting plants, leaf axils, buds and flowers. Galls can contain up to 80 chambers, each will a single larva. In cultures in a laboratory, females produced an average of 61 offspring. These galls interrupt and stunt the normal growth of the plant, and reduce its flowering. Adults emerge from the galls after a few weeks, and there can be several generations over a growing season.

Current status

The Plant Health and Production Division, Canadian Food Inspection Agency granted the gall midge official approval for field release, in March 1999. ARC has been rearing the gall midge on potted scentless chamomile plants in the greenhouses at Vegreville, and the colony is thriving. The biggest problem is producing enough scentless chamomile plants to supply it! The gall midge is able to survive over winter under Canadian conditions.

Gall midges have travelled 10 km in 4 yrs.

Plans for 2004

In Saskatchewan, gall midges will be collected and sent to those requesting the biological control agent. The agent supply is expected to be in short supply. Multiple releases are planned for the City of Yorkton.

It is possible to establish gall midges by transplanting scentless chamomile plants with galls that are obtained from previous releases. When growth commences in the spring, it is time to dig up scentless chamomile plants with galls. Transplant the plant with its gall(s) intact to a new location. Water if the soil is dry. As the adult midges emerge from galls, they should lay eggs on the surrounding plants to start up a new field population.

ARC will supply the gall midge this year for $200/release.

Please contact ARC directly for details on shipping and the fee.

Dr. Alec McClay
Alberta Research Council
PO Bag 4000
Vegreville, Alberta T9C 1T4
Tel.: 780-632-8207
Fax: 780-632-8612
E-mail: alec@arc.ab.ca.

Selecting a Release Site

While choosing a suitable site for release will greatly increase gall midge establishment, it is not known what habitat or environmental factors affect establishment. However, try to meet the following general criteria.

1) After release, do not disturb a release site. A site should not be treated with herbicides, tilled or mowed, and should receive little to no grazing until the insects establish a stable population. Try to protect the site for at least five years.

2) A site should be large enough to support a developed gall midge population. The site should contain many rather than a few scentless chamomile plants.

Establishing a Release Site

Equipment Needed

To properly release gall midges, you will need the following equipment:

- stake
- sledge hammer

- camera
- pen and paper
- $^1/_4$ m^2 quadrat
- shovel
- GPS equipment

Stake and photograph the release site for future reference. Use the $^1/_4$ m^2 quadrat to sample the density of scentless chamomile. Dig a hole in the soil with a shovel and transplant the scentless chamomile plants with galls. It is highly desirable to obtain the GPS coordinates for the site. Please complete a copy of the release form, which is printed in this document and forward it to the author.

Selecting the Release Point

Although many scentless chamomile infestations are located near sloughs or low-lying areas, select an upland site away from water, including the high spring water level.

Making the Release

Release the insects in the centre of the stand and mark the release site with a clearly visible stake.

Adult gall midges live for only a few hours so it is necessary to transport the biological control agent with scentless chamomile plants. Transplant 12 plants with gall midges in to a patch of scentless chamomile. Adult gall midges tend to come out as groups and then live for only a few hours. Because a group is either all males or females, transplant 12 plants per site to ensure mating.

To ensure the successful establishment of the scentless chamomile plant and gall midge, it is important to **water the plants when the soil becomes dry.**

Finally, a release record sheet should be completed and sent to the author.

The release record sheet used by Saskatchewan Agriculture, Food and Rural Revitalization is included in this report. Information on site characteristics is important to determine insect establishment and to assess the effect gall midges will have on scentless chamomile. Use a $^1/_4$ m^2 quadrat to sample the number of flowering stems per square meter.

This information is essential to determine the appropriate conditions for a successful gall midge biological control site. Sharing the pooled release data benefits all biological control participants in the long term.

Seed Weevil *(Omphalapion hookeri)* Release Form

Scentless Chamomile

Release Number: ____________________ Date: ______________
Legal Location: ____________________ Number Released: ______________
GPS Reading: ____________________ RM # ______________

Released by:
Name: ______________________________
Address: ______________________________
City: ______________________________
Postal Code: ______________________________
Phone: ______________________________

Landowner: (if different from release person)
Name: ______________________________
Address: ______________________________
City: ______________________________
Postal Code: ______________________________
Phone: ______________________________

Site Characteristics (check applicable choices)

Biological

Infestations (check one)	_____ Continuous	_____ Patchy	
Extent:	_____ <2.5 ha (<6 acres)	_____ 2.5-10 ha (6 - 25 acres)	_____ >10 ha (>25 acres)
Flowering stems/m2	_____ 0-20	_____ 20-35	_____ >35
Cover (all vegetation):	_____ 0-25%	_____ 20-75%	_____ 75-100%
Trash cover:	_____ 0-5% _____ 25-50%	_____ 5-10%	_____ 10-25%

Weather conditions: (temperature, sunny rain, etc.) ______________________________________
____

Land Use

Current use _____ Pasture _____ Crop _____ Right-of-way
_____ Other ⇨ describe: ____________________

Herbicides within 2 yrs: _____ Yes _____ No
if yes, type: ______________________________
rate: ______________________________

Miscellaneous Information

(comments concerning adverse weather or agronomic conditions that could influence either insect#'s (ie pesticide drift) or the weed stand)

____
____
____
____

Return to:
Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK, S7K 2H6
Phone: 933-7695, Fax: 933-7352 e-mail: gbowes@agr.gov.sk.ca

Seed Weevil (Omphalapion hookeri) Field Data Sheet 1:

Scentless Chamomile Presence or Absence

SITE DATA

Release Number: ____________ Date: ________________

Assessment person(s): ________________ RM: ________________

(please specify all parties taking part in the **COUNTING**)

____

____

Contact Phone: ________________ Legal Location: ________________

SAMPLING DATA:

Time: ____________ Temperature: ____________

Weather conditions at time of sampling (sunny, windy, etc.): ________________

____

Weed patch size: ____________

Plant Phenology:
(Check predominant one)

_______ No flower buds showing (vegetative)

_______ Early bud stage

_______ Flowers starting to open

INSECT DENSITY ESTIMATE

_______ YES Presence of adults found in 30 minutes

If yes, time taken to find adults : _________

or number of adults found in 30 minutes: _______

_______ NO (adults not found in 30 minutes)

Approximate area searched: ____________

MISCELLANEOUS INFORMATION

(comments concerning adverse weather or agronomic conditions that could influence either insect #'s (i.e. pesticide drift) or the weed stand)

____

____

____

Return to:
Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK S7K 2H6
Phone: 306 933-7695, Fax: 306 933-7352, E-mail: gbowes@agr.gov.sk.ca

Seed Weevil (*Omphalapion hookeri*) Field Data Sheet 2:

Scentless Chamomile Assessment

SITE DATA

Release Number: ______________ Date: ____________
Assessment person(s): ______________ RM: ____________
Contact phone #: ______________ Legal Location: ____________

SAMPLE DATA (check applicable choices)

Biological

Infestations (check one)	_____ Continuous	_____ Patchy	
Extent:	_____ <2.5 ha (<6 acres)	_____ 2.5-10 ha (6 - 25 acres)	_____ >10 ha (>25 acres)
Flowering stems/m2	_____ 0-20	_____ 20-35	_____ >35
Cover (all vegetation):	_____ 0-25%	_____ 20-75%	_____ 75-100%
Trash cover:	_____ 0-5% _____ 25-50%	_____ 5-10%	_____ 10-25%

Chemical

Herbicides within past year: _____ yes _____ no
if yes, type: ______________________________
rate: ______________________________

MISCELLANEOUS INFORMATION

(comments concerning adverse weather or agronomic conditions that could influence either insect#'s (ie pesticide drift) or the weed stand)

____
____
____
____

Return to:
Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK S7K 2H6
Phone: 306 933-7695, Fax: 306 933-7352, E-mail: gbowes@agr.gov.sk.ca

Stem Weevil *(Microplontus edentulus)* Release Form

Scentless Chamomile

Release Number: ____________
Legal Location: ____________
GPS Reading: ____________

Date: ____________
No. Released: ____________
RM # ____________

Released by:
Name: ____________
Address: ____________
City: ____________
Postal Code: ____________
Phone: ____________

Landowner: (if different from release person)
Name: ____________
Address: ____________
City: ____________
Postal Code: ____________
Phone: ____________

Site Characteristics (check applicable choices)

Biological

Infestations (check one)	_____ Continuous	_____ Patchy	
Extent:	_____ <2.5 ha (<6 acres)	_____ 2.5-10 ha (6 - 25 acres)	_____ >10 ha (>25 acres)
Flowering stems/m2	_____ 0-20	_____ 20-35	_____ >35
Cover (all vegetation):	_____ 0-25%	_____ 20-75%	_____ 75-100%
Trash cover:	_____ 0-5% _____ 25-50%	_____ 5-10%	_____ 10-25%

Weather conditions: (temperature, sunny rain, etc.) ____________

____

Land Use

Current use	_____ Pasture	_____ Crop	_____ Right-of-way
	_____ Other	⇨ describe: ____________	
Herbicides within 2 yrs:	_____ Yes	_____ No	

if yes, type: ____________
rate: ____________

Miscellaneous Information

(comments concerning adverse weather or agronomic conditions that could influence either insect#'s (ie pesticide drift) or the weed stand)

____
____
____
____

Return to:
Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK S7K 2H6
Phone: 306 933-7695, Fax: 306 933-7352, E-mail: gbowes@agr.gov.sk.ca

Gall Midge (Rhopalomyia tripleurospermi) Release Form

Scentless Chamomile

Release Number: ____________	Date: ____________
Legal Location: ____________	No. Released: ____________
GPS Reading: ____________	RM # ____________
Released by:	**Landowner:** (if different from release person)
Name: ____________	Name: ____________
Address: ____________	Address: ____________
City: ____________	City: ____________
Postal Code: ____________	Postal Code: ____________
Phone: ____________	Phone: ____________

Site Characteristics (check applicable choices)

Biological

Infestations (check one)	_____ Continuous	_____ Patchy	
Extent:	_____ <2.5 ha (<6 acres)	_____ 2.5-10 ha (6 - 25 acres)	_____ >10 ha (>25 acres)
Flowering stems/m2	_____ 0-20	_____ 20-35	_____ >35
Cover (all vegetation):	_____ 0-25%	_____ 20-75%	_____ 75-100%
Trash cover:	_____ 0-5% _____ 25-50%	_____ 5-10%	_____ 10-25%

Weather conditions: (temperature, sunny rain, etc.) ______________________________

____

Land Use

Current use	_____ Pasture	_____ Crop	_____ Right-of-way
	_____ Other	⇨ describe: ____________	
Herbicides within 2 yrs:	_____ Yes	_____ No	

if yes, type: ______________________________

rate: ______________________________

Miscellaneous Information

(comments concerning adverse weather or agronomic conditions that could influence either insect#'s (ie pesticide drift) or the weed stand)

____

____

____

____

Return to:
Garry Bowes, 3830 Thatcher Avenue, Saskatoon, SK, S7K 2H6
Phone: 933-7695, Fax: 933-7352 e-mail: gbowes@agr.gov.sk.ca

MONITORING RECORD FOR Gall Midge (*Rhopalomyia tripleurospermi*)	**Release Identifier:** ____________
Date monitored (YYMMDD)	Time Monitored (range)____________
Agent Name *Rhopalomyia tripleurospermi* Weed Scientific Name *Matricaria perforata* Weed Common Name scentless chamomile	Site Name/Location ____________ ____________

Monitored by

Last Name	First Name	Affiliation	Telephone
			( ) -

Photographs taken? Y/N

Frame Numbers

Monitoring information

How many of the original nine transplanted plants are alive?	Weed Canopy Height cm

Please search, first within your original transplant square, and then in the immediately surrounding area for galls. Search until you find ten galls (not including those on the transplanted plants) or for 30 minutes, whichever comes first. For each gall, indicate how far and which direction it is from the nearest transplanted plant if it is not within the original transplant square. Also indicate on which part of the plant the gall was found (see attached pictures).

Gall #	Found within transplant square?	Which type/where is the gall on the plant?					
1	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
2	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
3	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
4	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
5	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
6	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
7	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
8	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
9	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other
10	Y/N	rosette	shoot base	shoot tip	leaf axil	flower	other

Greatest distance of insect spread	Direction of greatest insect spread	**If you found ten galls in less than 30 minutes, approximately how long did it take?**

OTHER NOTES:

Table 1. List of Release Sites for Scentless Chamomile Seed Weevils

(Adult # Found = Adult number found in a spring count.
% Heads Infested = Percentage of seed heads with at least one weevil in the fall.)

RM 6	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 14-1-12 W1	18-Jun-99	60	?			
SK-99-126						
Contact Person:	Hugh Schnell	Phone #:	923-4604	GPS:	49.04	103.4975 Cal
Comments:						

RM 32	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 4-4-3 [illegible]	[illegible]	30	>35			
SK-01-16 [illegible]						
Contact [illegible]	[illegible]	Phone #:	482-9671	GPS:	49.2688	101.7284 Cal
Comment [illegible] 489-4812. Released in a pasture.						

RM [illegible]	[illegible]	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 4-4-3 W1	11-Jun-01	60	0-20			
SK-01-181						
Contact Person:		Phone #:		GPS:		
Comments: Landowner: John McNeil 489-4812. Edge of slough in a crop field.						

RM 49	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 31-5-19 W3	17-Jun-99		20-35			
SK-99-105						
Contact Person:		Phone #:		GPS:	49.4329	108.5395 Cal
Comments:						

RM 63	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 5-7-2 W2	8-Jun-01	30	0-20			
SK-01-167						
Contact Person:		Phone #:		GPS:	49.5273	102.248 Cal
Comments: Landowner; Jack Doty 453-6013						

RM 63	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 5-7-2 W2	11-Jun-01	60	0-20			
SK-01-178						
Contact Person:		Phone #:		GPS:	49.5273	102.2428 Cal
Comments: Landowner: Jack Doty 453-6013. Released on the edge of a slough in a crop field.						

RM 94	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 36-12-5 W2	5-Jun-01	60	0-20			
SK-01-161						
Contact Person:	Larry Wiesner	Phone #:	736-2655	GPS:	50.0367	102.563 Cal
Comments: Landowner: Ken Shoemaker						

RM 98	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 23-11-17 W2	17-Jun-99	60	>35	2000	0	
SK-99-123				2003	0	

Contact Person: Phone #: GPS: 49.9304 104.22482

Comments: Also contact person, Ray Beck. Agriculture Fieldworker for RM #98. Released near the gall midge sites. Owner decided to control all scentless chamomile in crop and right-of-way; Roundup in fall of 1999, Roundup in spring of 2000 and in crop herbicide. 2003: Continue to fill slough. Very few plants. GPS1 WP037.

RM 98	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 24-11-17 W2	7-Jun-00	60	>35	2000	0	
SK-00-153				2003	0	

Contact Person: Phone #: GPS: 49.93052 104.1985

Comments: Release between road, road right-of-way and abandoned dugout. 2003: Very few plants. 2003 P3 - 025 GPS1 WP038.

RM 98	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 25-11-17 W2	9-Jun-00	60	20-35	2000		
SK-00-154				2003	0	

Contact Person: Phone #: GPS: 49.94206 104.20364

Comments: Released along the grassed edge of the Yellow Grass main drainage ditch in cultivated land, behind the old stone house. To wet to sample on July 12, 2000. 2002: Old galls, gall on a perennial (2), old gall. P11 - 008, 009, 010, 011. 2003: Very few plants. GPS1 WP122.

RM 109	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 22-10-20 W3	9-Jun-00	60	0-20			
SK-00-151						

Contact Person: Phone #: GPS: 49.8331 108.6255 Cal

Comments:

RM 109	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 22-10-20 W3	30-Aug-96		20-35			
SK-96-058						

Contact Person: Al Holtsmeyer Phone #: 662-3599 GPS: 49.8404 108.6368 Cal

Comments:

RM 109	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 36-10-20 W3	8-Jun-01	25				
SK-01-173						

Contact Person: Darcy Jacksteit/D. Aldag Phone #: 672-37-28 GPS: 49.8695 108.5834 Cal

Comments: Landowner: Don Aldag 672-3728.

RM 109	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 22-10-20 W3	17-Jun-99	60	0-20			
SK-99-111						

Contact Person: Phone #: GPS: 49.8404 108.6368 Cal

Comments:

RM 110	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SW 12-10-22 W3	9-Jun-00	60	0-20				
SK-00-150							
Contact Person:		Phone #:		GPS:	49.804	108.8627 Cal	
Comments:							

RM 121	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NW 9-14-31 W1	7-Jun-01	60	20-35				
SK-01-166							
Contact Person:	Marshall McLeod	Phone #:	435-4242	GPS:	50.1749	101.6649	Cal
Comments: Landowner: Konrod Johnson							

RM 121	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NE 33-13-31 W1	1996			1999	0		
SK-96-067				2003	4		
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.14235	101.65882	
Comments: On the roadway, east of the elevator. The site was mowed. 2003: Site photo. 2003 P3 - 013. GPS1 WP185.							

RM 121	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SW 7-14-31 W1	*****	*****	*****	2002	20	*****	
SK-				2003	116		
Contact Person:	M. McLeod	Phone #:	435-4242	GPS:	50.16708	101.70925	
Comments: 2002: East of Mainline Terminal. Photo 2002 P3 - 007. 20 found in 30 min. 2003: 77 found in 20 min. Five weevils on a flower, site. 2003 P3 - 011, 012. GPS1 WP208.							

RM 122	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NW 1-15-33 W1	1-Sep-95		>35	1996	10		
SK-95-??							
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.2484	101.9038 Cal	
Comments: 1997: Site was under water all year. 1999: Site destroyed.							

RM 122	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SW 1-15-33 W1	1996			1999	112		
SK-96-071				2002	454		
				2003	171		
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.25455	101.92494	
Comments: Released on the left side of the rock pile near the slough. 2002: Weevils at rock pile, isolated plant, site with weevils, close up. Photo 2002 P3 - 008, 009, 010, 011. 227 found in 15 min. 2003: Many weevils on plants and rock pile. 2003 P3 - 008, 009, 010. GPS1 WPAA09.							

RM 123	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SW 30-15-2 W2	1-Sep-95	500	>35	1996	0		
SK-95-??				1997		16	
				1998		10	
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.284	102.2691 Cal	
Comments:							

RM 124	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 25-15-6 W2 SK-95-040	1-Sep-95	500	0-20	1996	0	
Contact Person:		Phone #:		GPS:	50.2913	102.6932 Cal
Comments: 1996: Cattle grazed the release site and plants were short.						

RM 124	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 20-13-6 W2 SK-00-157	6-Jun-00	60	0-20			
Contact Person:		Phone #:		GPS:	50.1022	102.7904 Cal
Comments:						

RM 130	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 30-13-22 W2 SK-99-121	17-Jun-99	60	0-20			
Contact Person:		Phone #:		GPS:	50.1095	104.9856 Cal
Comments: Requested by Ian Dow.						

RM 151	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 3-18-33 W1 SK-95-??	1-Sep-95		0-20	1996	1	1
				1997		3
				1998		2
				1999	31	5
				2000		0
				2003	36	
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.51102	101.96202
Comments: 1997: No plants at release site but on the opposite side of the road, along the road edge there were lots of plants and lots of weevils. 2000: Found only 3 seed heads. 2003: Few plants growing on road shoulder and on gravel site in brome. 2003 P3 - 017. GPS1 WPAA08.						

RM 151	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 13-17-32 W1 SK-96-068	2-Sep-96		0-20	1997	2	
				1999	20	14
				2000		100
				2003	0	
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:		
Comments:1997 - No scentless chamomile plants at the release site. S.C. plants were 50 yds uphill and 100 yds downhill. Plants were found across the road. 2000: Found only 2 seed heads. 2003: No plants found. GPS1 WPAA07.						

RM 153	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 14-18-1 W2 SK-01-174-01	9-Jun-01	30				
Contact Person:	G Swanson	Phone #:	735-2879	GPS:	50.5169	102.0401 Cal
Comments: Landowner:, Denis Fiakola, 745-3747.						

RM 153	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 36-17-2 W2	9-Jun-01	30		2003	23	
SK-01-174-02						
Contact Person:	G. Swanson	Phone #:	735-2879	GPS:	50.44986	102.21236
Comments: Landowner: RM of Willowdale. Release on a right-of-way. 2003: Photo. 2003 P3 - 020. GPS1 WP207.						

RM 153	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 17-18-1 W2	1-Sep-95	500	0-20	1996	2	
SK-95-??				1998		0
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.5242	102.0973 Cal
Comments: 1996: No plants at the release site. Weevils were found 10' from the release site at the edge of the road. 1998: No plants, the area was cleaned up. 1999: Site lost.						

RM 153	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 20-16-2 W2	1-Sep-95	500				
SK-95-??						
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.3568	102.2462 Cal
Comments: 1999: Site destroyed.						

RM 153	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 26-17-2 W2	1996	60		1999	1	
SK-96-069				2003	138	
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.45529	102.16683
Comments: Found the weevil along the field edge. 2003: 5 weevils on a branch, field corner. 2003 P3 - 018, 019. GPS1 WP187.						

RM 153	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 20-16-2 W2	2-Sep-96	500	20-35	1997		0
SK-96-070						
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.3568	102.2348 Cal
Comments: 1999: Site destroyed.						

RM 154	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 5-17-4 W2	1995	60		1999	85	
SK-95-044				2002	722	
				2003	103	
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS:	50.39702	102.52233
Comments: Moved 500 ft from the original site to the field. 2002: Close up, plants with weevils, release area, plants with weevils behind release site. Photo 2002 P3 - 012, 013, 014, 015. 361 found in 15 min. 2003: Scentless chamomile at edge of the field. 2003 P2 - 004, 005, 006. GPS1 WPAA15.						

RM 156	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SE 24-18-13 W2	1-Sep-95	500	>35	1997		0	
SK-95-043				1999	2		
				2002	120		
				2003	71		
Contact Person:			Phone #:		GPS:	50.5278	103.66347
Comments: 1999: Weevils were released by transformer. The areas was mowed in the spring and sprayed with Ally in the spring of 1999. 2002: Looks like a perennial plant, weevils on plants along CPR, release site. Photo 2002 P3 - 016, 017, 018. 120 found in 30 min. 2003: 47 found in 20 min. 2003 P1 - 019. GPS1 WP189.							

RM 156	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SE 24-18-13 W2	1-Sep-95	500	>35	1997		0	
SK-95-044				1999	2		
Contact Person:			Phone #:		GPS:	50.5315	103.6557 Cal
Comments:							

RM 157	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NE 08-19-16 W2	9-Jun-00	60		2003	7		
SK-00-152							
Contact Person:			Phone #:		GPS:	50.59469	104.17687
Comments: 2000: Requested by Mike Champion, Ducks Unlimited. 2003: Area sampled. 2003 P3 - 004. GPS2 WP420.							

RM 157	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NW 9-18-16 W2	1-Sep-95	500	0-20	1997		0	
SK-95-037				1999	4		
				2002	0		
Contact Person:			Phone #:		GPS:	50.50655	104.1562
Comments: 1999: Released in a low area, the weevils have moved to the field edge by the trees. 2002: Site along the highway ROW, GPS reading could be incorrect. GPS1 WP190.							

RM 157	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SE 6-20-18 W2	1-Sep-95	500	0-20	1997		0	
SK-95-038				1999	0		
Contact Person:			Phone #:		GPS:	50.65928	104.47692
Comments: 1999: The release site is a wet area by a nearby field of alfalfa. GPS1 WP191.							

RM 157	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SW 18-18-15 W2	1-Sep-95	500	0-20	1997		0	
SK-95-039							
Contact Person:			Phone #:		GPS:	50.5169	104.0566 Cal
Comments:							

RM 157	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 28-18-14 W2	1-Sep-95	500	0-20	1997		0
SK-95-041				1999	154	53
				2000	486	55
				2002	1130	
				2003	393	

Contact Person: Phone #: GPS: 50.54684 103.87364 Cal

Comments: 1999: Qu'Appelle site. Weevils are along the road, moving south. 2002: Close up, best area for weevils. Photo 2002 P3 - 021, 022. 565 found in 15 min. 2003: 131 in 10 min. 2003 P1 - 016, 017 GPS1 WPAA10.

RM 157	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 18-18-15 W2	1-Sep-95	500	20-35	1999	10	39
SK-95-042				2000		52
				2002	154	
				2003	69	

Contact Person: Phone #: GPS: 50.51637 104.05695 Cal

Comments: 1999: Released by fence, moved around to the side of the fence. Wood Country is aware of the weed and is controlling it. 2002: Lumber yard, plant in drainage ditch, area and ditch. Photo 2002 P3 - 023, 024, 025. 77 found in 15 min. 2003: 23 found in 10 min. 2003 P1 - 020, 021, 022. GPS1 WPAA11.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 30-19-18 W2	7-Sep-95	500	0-20	1996	0	
SK-95-025				2003	0	

Contact Person: Phone #: GPS: 50.63584 104.48117

Comments: 1996: No scentless chamomile at the release stake. Area may have been flooded. 1999: Entrance road flooded, did not sample. 2003: No scentless chamomile plants. GPS2 WP418.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 5-20-18 W2	1-Sep-95	500	0-20	1996	2	
SK-95-027				1999	0	
				2003	48	

Contact Person: Phone #: GPS: 50.65928 104.47692

Comments: 1996: Very wet area, good weed stand. 1999: Very few plants to search, site failed. Weevils may have moved to adjacent 2 quarter sections with solid stands of scentless chamomile. 2003: Plant with 9 weevils, plant with 10 weevils, view from release post. 2003 P2 - 024, 025, 026. GPS1 WP192.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 4-20-18 W2	7-Sep-95	500	0-20	1996	0	
SK-95-028				1999	0	
				2003	6	

Contact Person: Phone #: GPS: 50.66035 104.44698

Comments: 1996: Stake submerged in water, possible flooded out. 1999: No scentless chamomile at release site, site failed. Very few plants, mostly on old burrowing animal mounts. 2003 P2 - 001, 002. GPS2 WP415.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE/NW 33-19-18 W2	7-Sep-95	500	0-20	1996	0	
SK-95-029				1999	2	
				2003	36	

Contact Person: Phone #: GPS: 50.65854 104.44309

Comments: 1996: Release stake submerged in water. 1999: could not find the release stake, field had been hayed. 2003: In photo, perennial plant no controlled in direct seeded field. 2003 P2 - 003, 004. GPS2 WP414.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 18-20-17 W2	7-Sep-95	500	0-20	1996	0	
SK-95-030				2003	34	

Contact Person: Phone #: GPS: 50.69755 104.35907

Comments: 1996: Stake submerged in 2' of water. Site destroyed. 2003: Scentless chamomile on field edge. 2003 P2 - 006. GPS2 WP413.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 4-20-17 W2	1-Sep-95	500	0-20	1996	0	
SK-95-031				2003	5	

Contact Person: Phone #: GPS: 50.6719 104.29397

Comments: 1996: No scentless chamomile within 5 m of the stake. 1999: could not find the release stake, site lost. GPS2 WP412.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 36-19-17 W2	7-Sep-95	500	0-20	1996	3	
SK-95-033				1999	6	
				2002	126	
				2002	114	

Contact Person: Phone #: GPS: 50.65067 104.22425

Comments: 1996: Small scentless chamomile stand, possible chemical damage. 2002: Photo 2002 P2 - 020, 021. 126 found in 30 min. Plants with weevils. 2003: Scentless chamomile along field edge-grassland, weevils on plants well within the grassland. 2003 P2 - 014, 015. GPS1 WP196.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 16-19-17 W2	6-Sep-96	500	0-20	1999	9	
SK-96-001				2002	119	
				2003	77	

Contact Person: Phone #: GPS: 50.60158 104.31622

Comments: 1999: Little scentless chamomile at original site. Weevils moved across the road. 2002: Photo 2002 P2 - 009, 010, 011, 012, 013, 014, 015. 119 found in 30 min. 2003: Photo of plants with weevils, a disturbed area in ROW and at the field entrance. 2003 P2 - 011, 012. GPS1 WP197.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 6-20-18 W2	6-Sep-96	500	0-20	1999	3	
SK-96-002				2003	170	

Contact Person: Phone #: GPS: 50.65949 104.48058

Comments: 1999: Release site is covered with quack grass and the weevils have moved to a nearby large field. 2003: Four weevils in a head, plants with 72 weevils in disturbed area. 2003 P2 - 020, 021. GPS2 WP416.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 30-19-18 W2	30-Aug-96	500	0-20	2003	183	
SK-96-003						

Contact Person: Phone #: GPS: 50.63571 104.48046

Comments: 1999: Entrance road was to wet, did not sample. 2003: Slough with scentless chamomile and weevils, patch with 123 weevils. 2003 P - 022, 023. GPS2 WP419.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 18-20-17 W2	6-Sep-96	500	>35	1999	1	
				2002	89	
SK-96-004				2003	159	

Contact Person: Phone #: GPS: 50.69943 104.36068 Cal

Comments: 1999: No scentless chamomile at the release point. Weevils have moved to the shelterbelt. 2002: Site photo. 2002 P3 - 003. 2003: In photo, plants on right have weevils, not many plants on the left, not many plants have weevils, Roundup damage. 2003 P2 - 007. GPS1 WP199.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 18-20-17 W2	6-Sep-96	500	0-20	1999	24	27
SK-96-005				2000		91
				2002	165	
				2003	63	

Contact Person: Phone #: GPS: 50.68923 104.36143

Comments: 1999: Original patch has disappeared. Weevils have moved across the road. 2002: 165 found in 30 min. Edge 2, lake no scentless chamomile, solid scentless chamomile 1999. Photo 2002 P2 - 024, 025. 2003: Field of scentless chamomile. 2003 P2 - 005. GPS1 WPAA13.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 19-20-18 W2	6-Sep-96	500	0-20			
SK-96-006						

Contact Person: Phone #: GPS: 50.706 104.4873 Cal

Comments: 1999: Entrance road in was wet, did not sample.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 2-20-17 W2	6-Sep-96	500	20-35	1999	20	0
SK-96-007				2000		0
				2002	6	
				2002	171	

Contact Person: Phone #: GPS: 50.64968 104.24712

Comments: 2000: Could find only 8 seed heads to sample. 2002: Scentless chamomile in slough, edge of crop-brome. Photo 2002 P2 - 018, 019. 6 found in 30 min. 2003: 57 found in 10 min. Weevils on plants at the edge of sprayed slough, no scentless chamomile plants in ROW. 2003 P2 - 013. GPS1 WPAA14.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 25-18-18 W2	30-Aug-96	500	>35	1999	0	
SK-96-008				2000	3	
				2003	5	

Contact Person: Phone #: GPS: 50.55625 104.36318

Comments: 1999: No scentless chamomile. The site has been cleaned up. 2002: 3 found in 30 min on a few scentless chamomile plants in a yard were the farmer is trying to pick all plants. 2003: Weevils in shelter belt to the east. GPS1 WP200.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 8-19-18 W2	26-Aug-96	500	0-20	1999	6	
SK-96-009				2002	430	
				2003	245	

Contact Person: Phone #: GPS: 50.59918 104.45563

Comments: 1999: Weevils have moved across the road. 2002: Scentless chamomile along field edge, on scentless chamomile with cattails. Photo 2002 P3 - 004, 005. 215 found in 15 min. 2003: Photos, scentless chamomile around field and plant in slough. 2003 P1 - 023, 024. GPS1 WP201.

RM 158	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 23-18-18 W2	30-Aug-96	500	0-20	1999	1	
SK-96-010				2002	5	
				2003	0	

Contact Person: Phone #: GPS: 50.54235 104.38105

Comments: 1999: Large area with scentless chamomile nearby. 2002: No weevils on road shoulder, weevils in ROW, scentless chamomile in grass and grass-alfalfa pasture. Photo 2002 P2 - 004, 005, 006. 5 found in 30 min on scentless chamomile plants in the ditch. 2003: No scentless chamomile in ROW, no weevils on plants in pasture. 2003 P2 - 010. GPS1 WP203.

RM 184	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 10-20-4 W2	1995			1999	106	
SK-95-?						

Contact Person: Phone #: GPS: 50.70884 102.47565

Comments: 1999: Released by a rock, area was cultivated but the weevils have moved over the area. GPS1 WP202.

RM 184	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 10-20-4 W2	1995			1999	106	
SK-95-?						

Contact Person: Phone #: GPS: 50.70884 102.47565

Comments: 1999: Released by a rock, area was cultivated but the weevils have moved over the area. GPS1 WP202.

RM 186	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 2-21-12 W2	1995			1999	11	
SK-95-004				2002	70	

Contact Person: Phone #: GPS: 50.76805 103.58237

Comments: 1999: An isolated area, a waterway with scentless chamomile growing in four small patches. 2002: Release site, 8 plants, weevils on plants on the other side of road. Photo 2002 P3 - 019. 70 found in 30 min. GPS1 WPAA12.

RM 187	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 36-20-17 W2	1-Sep-95	500	0-20	1996	0	
SK-95-032				1999	0	
				2002	3	
				2003	12	

Contact Person: Phone #: GPS: 50.73787 104.22301 Cal

Comments: 1996: Stake submerged in water, possible spring flooded out. 1999: scentless chamomile present, could not locate release stake, site lost. 2002: Weevils on cattails, field edge. Photo 2002 P2 - 022, 023. 3 found in 30 min. 2003: 6 found in 15 min. Slough ploughed up, no plants in wooded area. A few plants along the edge. 2003 P2 - 008. GPS1 WP195.

RM 189	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 35-19-19 W2	7-Sep-95	500	0-20	1996	2	
SK-95-026				2003	198	

Contact Person: Phone #: GPS: 50.6587 104.54201

Comments: 1999: Could not find the release point, did not sample, site lost. 2003: Road shoulder cut, plants with weevils beyond cut, slough with lots of weevils, few weevils with herbicide control. 2003 P2 - 016, 017, 018, 019. GPS2 WP417.

RM 190	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 24-21-23 W2	3-Jul-95	500	20-35	1997		0
SK-95-045				1998		0
				1999	0	5

Contact Person: Doug Patience Phone #: 638-4967 GPS: 50.79213 105.07791

Comments: 1999: Very little scentless chamomile at release site but scentless chamomile is nearby. GPS1 WP205.

RM 190	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 24-21-23 W2	29-Aug-96	500	20-35	1999	0	
SK-96-065						

Contact Person: Doug Patience Phone #: 638-4967 GPS: 50.7933 105.0531 Cal

Comments: 1999: Scentless chamomile disappeared from the site. Competitive grass.

RM 213	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 12-24-2 W2	30-Aug-96	500	20-35	1999	0	
SK-96-073				2002	28	

Contact Person: Phone #: GPS: 51.05578 102.15817

Comments: 1996: Released by Wendy Schatz around the land fill site north of Saltcoats. 2002: Site photo 2002 P1 - 20. 28 found in 30 min. GPS1 WP178.

RM 214	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NS 11-12-5 W2	1995			1999	55	
SK-95-?				2002	99	

Contact Person: Phone #: GPS: 50.88318 102.59823

Comments: 1999: Released on a hill, no scentless chamomile but weevils are moving along the field edge. Some weevils are on scentless chamomile growing in shade. 2002: Photo 2002 P1 - 25. 99 found in 10 min. GPS1 WPAA05.

RM 214	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 12-22-5 W2	1995			1999	43	
SK-95-?				2002	438	

Contact Person: Phone #: GPS: 50.8828 102.58349

Comments: 1999: Released on island in slough, near field, weevils have moved along the south edge of the slough. 2002: Photo 2002 P1 - 022, 023, 024. 146 found in 10 min. GPS1 WPAA04.

RM 218	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 18-23-16 W2	5-Jun-01	60	*****	*****	*****	*****
SK-01-164						

Contact Person: Phone #: GPS: 50.9533 104.2153 Cal

Comments: The site is at the north end of the yard site.

RM 221	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 29-23-24 W2	1-Aug-95	500	20-35	1996	0	
SK-95-046				1997		5
				1998		3
				1999	1	9
				2000		17

Contact Person: Doug Patience Phone #: 638-4967 GPS: 50.9897 105.3201 Cal

Comments: 1999: Search the area around the high water.

RM 221	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 29-23-24 W2	29-Aug-96	500	>35	1997		0
SK-96-066				1998		2
				1999	0	0.5

Contact Person: Doug Patience Phone #: 638-4967 GPS: 50.98912 105.32543

Comments: 1999: Could be a high spring water. Looks like herbicide damage on the plants. GPS1 WP182.

RM 243	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 31-25-3 W2	30-Aug-96	500	>35	1997		1
SK-96-074				1999	1	
				2002	121	

Contact Person: Phone #: GPS: 51.20511 102.4202

Comments: 1996: Released by Wendy Schatz. 1999: Released at the pile of soil at the east end of Yorkton. 2002: Photo 2002 P1 - 019. 121 found in 30 min. GPS1 WP177.

RM 253	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 12-24-29 W2	2001	60	0-20			
SK-01-160						

Contact Person: Phone #: GPS: 51.0261 105.9133 Cal

Comments: Landowner: Al Maier 734-2493. By a slough which the owner has sprayed for a number of years.

RM 277	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 13-29-14 W2	1-Sep-95	500	20-35	1999	24	23
SK-95-001				2000		55

Contact Person: Phone #: GPS: 51.50522 103.86198

Comments: 1999: Release by the sign at the land fill. GPS1 WPAA03.

RM **278**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
*****	12-Aug-03	400	*****	*****	*****	*****
SK-03-192						
Contact Person:	G. Kreitzer	Phone #:	835-2560	GPS:		
Comments: Released in an old yard.						

RM **301**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 32-31-31 W1	17-Jun-99	60	20-35			
SK-99-109						
Contact Person:		Phone #:		GPS:	51.7027	101.8209 Cal
Comments: Released in an area with scentless chamomile along a field margin and roadside.						

RM **307**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 12-32-13 W2	12-Aug-03	400	*****	*****	*****	*****
SK-03-193						
Contact Person:	Garry Bowes	Phone #:	933-7695	GPS:	51.73064	103.71095
Comments: Landowner SK Highways, Brian Jansen. Release in an old gravel pit. 2003: Site photo. 2003 P12 - 022. GPS2 WP430.						

RM **307**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 12-32-13 W2	12-Aug-03	400	*****	*****	*****	*****
SK-03-194						
Contact Person:	Garry Bowes	Phone #:	933-7695	GPS:	51.73126	103.71158
Comments: Landowner SK Highways, Brian Jansen. Release in an old gravel pit. 2003: Site photo. 2003 P12 - 023. GPS2 WP431.						

RM **307**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 12-32-13 W2	12-Aug-03	400	*****	*****	*****	*****
SK-03-195						
Contact Person:	Garry Bowes	Phone #:	933-7695	GPS:	51.73095	103.7117
Comments: Landowner SK Highways, Brian Jansen. Release in an old gravel pit. 2003: Site photo. 2003 P12 - 024. GPS2 WP432.						

RM **307**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 12-32-13 W2	12-Aug-03	400	*****	*****	*****	*****
SK-03-196						
Contact Person:	Garry Bowes	Phone #:	933-7695	GPS:	51.73042	103.71065
Comments: Landowner SK Highways, Brian Jansen. Release in an old gravel pit. 2003: Site photo. 2003 P12 - 025. GPS2 WP433.						

RM **307**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 27-31-15 W2	24-Aug-95	500	>35	1999	0	
SK-95-002				2002	0	
Contact Person:		Phone #:		GPS:	51.68995	104.05964
Comments: 1995: Site may be prone to flooding. 2002: Field farmed close to slough. Road ROW cleared by bull dozer. GPS1 WP179.						

RM **308**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 2-31-17 W2	1-Aug-95	500	20-35	2002	0	
SK-95-003						
Contact Person:	G J Kreitzer	Phone #:	835-2580	GPS:	51.62263	104.29672 Cal
Comments: 2002: Grass site with very few scentless chamomile plants. GPS1 WP181.						

RM **308**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 12-31-18 W2	1996			1999	6	
SK-96-?				2002	6	
Contact Person:		Phone #:		GPS:	51.63852	104.4385
Comments: 1999: Released by rock. 2002: Weevils found on banks of dugout. Photo 2002 P2 - 001, 002, 003. 6 found an 30 min along the banks of the dugout. GPS1 WP180.						

RM **320**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 18-32-22 W3	18-Jun-99	60	0-20			
SK-99-104						
Contact Person:		Phone #:		GPS:	51.7463	109.0996 Cal
Comments: Released in the yard adjacent to a school yard.						

RM **336**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 22-36-12 W2	29-Aug-95	500	>35			
SK-95-008						
Contact Person:		Phone #:		GPS:	52.1101	103.6362 Cal
Comments: 1999: Did not sample, site lost.						

RM **337**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 27-36-14 W2	1-Sep-95	500	>35			
SK-95-007						
Contact Person:		Phone #:		GPS:	52.1174	103.9218 Cal
Comments: 1999: Did not sample, site lost.						

RM **338**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Samples Collected	% Stems Infested
SE 10-34-16 W2	7-Jun-00	60	>35			
SK-00-155						
Contact Person:		Phone #:		GPS:	51.8992	104.1786 Cal
Comments: 2000: Edge of old yard, 50' west of the old house.						

RM **339**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 15-34-20 W2	17-Jun-99	60	20-35	2002	0	
SK-99-119						
Contact Person:		Phone #:		GPS:	51.9239	104.76326
Comments: Insects in poor condition when released. 2002: Each year scentless chamomile plants were pulled, so no plants. GPS1 WP131.						

RM **340**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 10-36-22 W2	17-Jun-99	60	20-35			
SK-99-120						
Contact Person:		Phone #:		GPS:	52.081	105.0524 Cal

Comments: Insects in poor condition when released. By 2001 the scentless chamomile plants were controlled because of the nearby water run.

RM **341**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 28-32-26 W2	2001	60	0-20			
SK-01-172						
Contact Person:	Russ Deneiko	Phone #:	259-4927	GPS:	51.7725	105.6191 Cal

Comments: Landowner: Saskatchewan Water 946-3200. Released on a road right-of-way near a water canal on the SW corner.

RM **341**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 27-32-25 W2	15-Jun-01	60	0 to 20			
SK-01-179						
Contact Person:	Ivan Allin	Phone #:	946-2440	GPS:	51.7682	105.4658 Cal

Comments: 2001: Site is located on road right-of-way, NW corner of the section.

RM **346**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 24-34-12 W3	18-Jun-99	60	0-20			
SK-99-101						
Contact Person:		Phone #:		GPS:	51.9356	107.5646 Cal

Comments: Abandoned railway right-of-way.

RM **346**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 24-34-12 W3	19-Jun-00	60				
SK-00-156						
Contact Person:		Phone #:		GPS:	51.9356	107.5646 Cal

Comments:

RM **352**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NW 34-35-26 W3	17-Jun-99	59	0-20	2000	0	
SK-99-115				2003	0	
Contact Person:		Phone #:		GPS:	52.05557	109.64156 Cal

Comments: 1999: Released on the edge of a field. 2000: A site by a slough. Grass surrounded the area around the stake. GPS1 WP075.

RM **366**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 17-37-11 W2	15-Sep-95	500	>35			
SK-95-009						
Contact Person:		Phone #:		GPS:	52.1756	103.541 Cal

Comments: 1999: Did not sample, site lost.

RM 381	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NW 10-37-24 W3	17-Jun-99	59	0-20	2000	9		
SK-99-114				2003	0		
Contact Person:			Phone #:		GPS:	52.17253	109.34991
Comments: 1999: Released in a abandoned yard. 2000: In a ditch, roadside was sprayed with dicamba. GPS1 WP073.							

RM 427	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NE 25-45-15 W2	24-Aug-95	500	>35	1996	0		
SK-95-017				1997		17	
				1999	119	95	
				2000	78	71	
				2002	153		
Contact Person:			Phone #:		GPS:	52.91452	104.04773
Comments: 2000: No scentless chamomile by the stake, the weevils have moved to the west and around the grove of trees. 2002: Photo 2002 P1 - 011,012. 51 found in 10 min. GPS1 WP047.							

RM 427	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NW 25-45-15 W2	14-Aug-95	500	>35	1996	0		
SK-95-018				1997		3	
				1999	7		
				2000	0		
				2002	28		
Contact Person:			Phone #:		GPS:	52.84097	103.84252
Comments: 2000: Acres of alfalfa nearby with some scentless chamomile. 2002: 14 weevils found on 18 plants in 30 min. GPS1 WPAA018.							

RM 427	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NE 36-45-15 W2	4-Sep-96	500	>35	1997		6	
SK-96-063				1997	14	41	
				2000	68	83	
				2002	204		
Contact Person:			Phone #:		GPS:	52.92261	104.03875
Comments: 2000: Yard around the release site is cleaned up. Weevils have moved by the dugout, some east to the field and by the wood pile. 2002: Photo 2002 P1 - 013. 68 found in 10 min. GPS1 WPAA02.							

RM 427	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
NE 25-45-15 W2	8-Sep-96	500	>35	1997		0	
SK-96-064							
Contact Person:			Phone #:		GPS:	52.9104	104.0372 Cal
Comments:							

RM 435	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested	
SE 4-45-10 W3	1997			1999			
SK-97-0003							
Contact Person:			Phone #:		GPS:	52.8449	107.3844 Cal
Comments: Could not find the release point along the roadside. Site lost.							

RM 435	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 4-45-10 W3	1997			1999		
SK-97-0004						

Contact Person: Phone #: GPS: 52.8449 107.3844 Cal

Comments: Could not find the release point along the roadside. Good grass competition and no scentless chamomile. Site lost.

RM 435	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 18-45-10 W3	1996			1999	>1	
SK-96-075-1						

Contact Person: Phone #: GPS: 52.87275 107.43463

Comments: 1999: Found the yellow post, a Ducks Unlimited site. Excellent forage establishment and no scentless chamomile. Site destroyed. GPS1 WP051.

RM 457	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 15-48-14 W2	24-Aug-95	500	>35	1996	0	
SK-95-019				1999	8	
				2000	2	
				2002	286	

Contact Person: Phone #: GPS: 53.13288 103.96454

Comments: Again lots black-fingernail clipping insects on flowers. Wasps and honey bees located approximately 0.4 km away. 2002: Weevils on 12 plants. Photo 2002 P1 - 015, 016, 017, 018. on the north side of the slough and into the slough from the west. 2002: 143 found in 15 min. GPS1 WP019.

RM 457	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 30-48-13 W2	14-Sep-95	500	20-35	1997		6
SK-96-062				1999		9

Contact Person: Phone #: GPS: 53.165 103.8829 Cal

Comments:

RM 457	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 30-48-13 W2	6-Sep-96	500	>35	1997		6
SK-96-062				1999	9	
				2000	18	
				2002	27	

Contact Person: Phone #: GPS: 53.11708 103.95863

Comments: 2000: In the chemical/fertilizer/seed dealers yard by trees and to the east. 2002: Found growing around bins. Photo 2002 P1 - 014. 9 found in 10 min. GPS1 WP062.

RM 457	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 36-46-13 W2	18-Jun-99	60	0-20			
SK-99-118						

Contact Person: Phone #: GPS: 53.005 103.7471 Cal

Comments: Release on an organic farm. has digital pictures.

RM **466**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 18-48-10 W3 SK-96-075-2	1996			1999		

Contact Person: Phone #: GPS: 52.87153 107.4349

Comments: 1999: Found the release point, a yellow electric fence post. Excellent forage stand and no scentless chamomile at the release point. Weevils were present at a slough 150-200 ft away. GPS1 WP053.

RM **487**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 18-50-14 W2 SK-96-076	10-Sep-96	500	>35	1999	0	
				2000	0	
				2002	0	

Contact Person: Phone #: GPS: 53.30831 104.0495

Comments: 1999: Site failed, reason unknown. 2000: Brome and quack grass moved into the release site, scentless chamomile has disappeared and no evidence that the weevils have moved to a new area. 2002: No scentless chamomile plants were found at the release site. GPS1 WP041.

RM **487**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 13-50-15 W2 SK-99-112	18-Jun-99	60	20-35	2002	128	

Contact Person: Phone #: GPS: 53.30807 104.05537

Comments: Released in an old gravel stock pile area. Near Microplontus release site. No assessment taken in 2000. 2002: 63 found in 15 min. Grasses and maples moving in. GPS1 WP052.

RM **487**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 13-50-15 W2 SK-00-158	9-Jun-00	60		2002	94	

Contact Person: Phone #: GPS: 52.87275 107.43463

Comments: 2002: 47 found in 15 min. GPS1 WP051.

RM **487**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 13-50-15 W2 *****	*****	*****	*****	*****	*****	*****

Contact Person: Phone #: GPS: 49.61697 108.88155

Comments: 2002: 73 found in 15 min. GPS1 WP052.

RM **494**	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 34-51-4 W3 SK-95-047	31-Aug-95	500	20-35	1997		1
				1999	78	51
				2000	160	41
				2002	98	
				2003	94	

Contact Person: Phone #: GPS: 53.44168 106.49878

Comments: Land owner, Lawrence Kvinlaug 468-5657 2002: 49 found in 30 min. 2003: 94 found in 30 min. 2003 P1 - 014 015 GPS1 WPAA16.

RM 494	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 28-51-5 W3 SK-95-048	31-Aug-95	500	20-35	1999	3	
				2002	0	

Contact Person: Phone #: GPS: 53.41525 106.66878

Comments: 1999: Released along the roadside. 2002: No scentless chamomile plants were found. GPS1 WP223.

RM 494	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SW 30-52-4 W3 SK-95-049	31-Aug-95	500	0-20	1999	1	
				2002	23	

Contact Person: Phone #: GPS: 53.51017 106.58157

Comments: 1999: Release was in the middle of the right-of-way of the road. 2002: 23 found in 30 min in old mounds of soil dug by animals. GPS1 WP224.

RM 494	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 2-51-5 W3 SK-95-050	31-Aug-95	500	20-35	1997		23
				1999	7	
				2000	158	
				2002	151	

Contact Person: Phone #: GPS: 53.36586 106.62538

Comments: A disturbed site in a ditch, a culvert was removed. 2002: 151 found in 30 min. GPS1 WP008.

RM 494	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SE 21-51-5 W3				2000	80	

Contact Person: Phone #: GPS: 53.4124 106.6696 Cal

Comments: 2000: Adjacent field sprayed with Roundup.

RM 494	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
NE 19-52-4 W3				2000	32	

Contact Person: Phone #: GPS: 53.5069 106.5713 Cal

Comments: 2000: Adjacent field sprayed with Roundup.

RM	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Adult # Found	% Heads Infested
SK-00-159						

Contact Person: Phone #: GPS:

Comments:

Table 2. List of Release Sites for Scentless Chamomile Gall Midges

RM 31	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 23-6-31 W1	22-Aug-01	9			
SK-01-R-026					

Contact Person: Del Chicoine Phone #: 449-2262 GPS: 49.4899 101.5592 Cal

Comments: Landowner: Leon Magotiaux 452-6193.

RM 78	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 16-08-18 W3	3-Oct-02	12	2003	Yes	3
SK-02-R-050					

Contact Person: Phone #: GPS: 49.64686 108.38929

Comments: Requested by Ray Dawson, 297-3819. Released in a pasture. 2003: New owner P. Milleaux. Gall and site 2003 P4 - 015, 016. GPS2 WP422.

RM 78	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
N 08-08-18 W3	3-Oct-02	12	2003	No	0
SK-02-R-041					

Contact Person: Phone #: GPS: 49.63579 108.40945

Comments: Landowner; Vern Mellor, 297-2824. Released in disturbed area of a pasture. 2003: Photo 2003 P4 - 011. GPS2 WP421.

RM 78	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 07-08-18 W3	26-May-03	12	2003	No	0
SK-03-R-055					

Contact Person: Phone #: GPS: 49.62687 108.42318

Comments: Landowner Ben Vause, 297-3910. 2003: Spring release, monitored on July 15, 2003. Site photo. 2003 P4 - 017. GPS2 WP423.

RM 79	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 30-07-19 W3	26-May-03	12	2003	Yes	6
SK-03-R-056					

Contact Person: Phone #: GPS: 49.5931 108.56836

Comments: Landowner Vince Stevenson, 297-3059, spring release. 2003: Site photo. 2003 P4 - 020, 021. GPS2 WP425.

RM 79	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 09-09-20 W3	3-Oct-02	12	2003	Yes	10
SK-02-R-046					

Contact Person: Phone #: GPS: 49.7245 108.65112

Comments: Requested by Earl Duncan, 297-2002. Release on scentless chamomile on hay land. 2003: Photo, site and gall. 2003 P4 - 018, 019. GPS2 WP424.

RM 79	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 35-7-20 W3	17-Jun-99	25	2000	Yes	10^+
SK-99-R-003			2001	Yes	10^+
			2002	Yes	10
			2003	Yes	10^+
Contact Person:	T. Lennox	Phone #: 297-5450	GPS: 49.60532	108.6084	

Comments: 1999: Released around a drainage ditch with saline soil. 2000: On July 10, the site was to wet to monitor. The site was revisited on September 20 and 10 galls were found in 10 min. 2001: Very few winter annual plant. All plants foun had galls. Evidence of galls on dead summer annual plants. Area flooded, winter annual scentless chamomile plants found in grassland near the disturbance caused by cattle. 2002: Area (2), close up, area, old gall, close up (2), area. Phot 2002 P12 - 001, 002, 003, 004, 005, 006, 007, 008. 2003: Site, lots of galls. 2003: P4 - 012,013,014. GPS1 WP114

RM 98	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 18-11-16 W2	23-Aug-01	9	2002		
SK-01-R-030					
Contact Perso		Phone #:	GPS: 49.9057	104.1781 Cal	

Comments: Landowner: Fred McClinton, farmed by Lorne McClinton 465-2549. Plants located on west end of dirt pile adjacent to road and drainage ditch. 2002: Could not find the site. Waypoint makes a point but the site has been cultivated GBP2 WP406.

RM 98	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 23-11-17 W2	17-Jun-99	25	2000	Yes	1
SK-99-R-004			2001	Yes	10^+
			2002	No	0
			2003	Yes	10
Contact Person:		Phone #:	GPS: 49.93054	104.22469	

Comments: Also contact person, Ray Beck. Agriculture Fieldworker for RM #98. Released the edge of an 80 acre field by the pole in a line to the north, adjacent to the "Yellow Grass Main" drainage ditch. Field was treated with Roundup in fall of 1999, Roundup in spring of 2000 and an in crop herbicide was applied. Field to the east was cultivated twice in the fall, plus a fall Roundup treatment. The in crop herbicide was Buctril M. 2001: Area was fall mowed. Galls were found below the mowed layer. No winter annual scentless chamomile plants were found. 2003: Site, gall, good control in field with scentless chamomile at field edge, 4 galls in small area. 2003 P3 - 021, 022, 023, 024. GPS1 WP037.

RM 98	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 24-11-17 W2	9-Jun-00	5	2000	Yes	4
SK-00-R-009			2001	Yes	10^+
			2002	No	0
			2003	No	0
Contact Person:		Phone #:	GPS: 49.93055	104.19855	

Comments: Site by abandoned dugout. Some of the roadside was mowed. The mower passed over some of the plants with galls. Land owned by Brian Dreger. Scentless chamomile is around the landfill and the gall midges have moved to the east site. Could not find any winter annual scentless chamomile plants, suspect grasshoppers. GPS1 WP121.

RM 98	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NW 25-11-17 W2	9-Jun-00	13	2000	Yes	10^{+}
SK-00-R-010			2001	Yes	10^{+}
			2002	Yes	10
			2003	No	0
Contact Person:		Phone #:		GPS: 49.94206	104.20364

Comments: Land owned by Victor Preb. Release was on the west side of the old house, across the drainage ditch, next to the field. The galls have moved to the east, 400 - 599 m. 2001: A good site for spring collection and re-location. 2002: Photo 2002 P11 - 008, 009, 010, 011. Galls on the base of perennial plants. Could not finds any winter rosettes, suspect grasshoppers. 2003: Very few plants. GPS1 WP122.

RM 109	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 36-10-20 W3	22-Aug-01	9			
SK-01-R-033					
Contact Person:	Don Aldag	Phone #:	672-3728	GPS: 49.8695	108.5804 Cal

Comments: Landowner: Don Aldag

RM 121	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 5-14-32 W1	29-Aug-01	9	2002	No	0
SK-01-R-016			2003	No	0
Contact Person:	Marshall McLeod	Phone #:	435-4242	GPS: 50.13804	101.68269

Comments: Landowner: Garnet Fawcett, Moosomin. 2002: Winter annual plant present but no galls. GPS2 WP405.

RM 121	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NW 9-14-31 W1	28-Aug-01	9	2002	Yes	10^{+}
SK-01-R-025			2003	Yes	10
Contact Person:	Marshall McLeod	Phone #:	435-4242	GPS: 50.16873	101.66926

Comments: Landowner: Kenrad Johnson, Moosomin. 2002: Release site. Photo 2002 P11 - 012. Excellent site in a construction equipment storage area, disturbance. 2003: 7 plants with galls and 2 without, damage by galls, good release site. 2003 P3 - 014, 015, 016. GPS2 WP404.

RM 153	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 16-16-3 W2	12-Jul-99	25	2000	Yes	10+
SK-99-R-005			2001	Yes	10+
			2002	No	0
			2003	No	0
Contact Person:	Cynthia Kitchen	Phone #:	435-2303	GPS: 50.33907	102.36518

Comments: Site was sprayed in the fall of 1999 or spring of 2000 to control scentless chamomile. The gall midge was present on some plants that emerged after Roundup was applied. (phone # 532-4410?). Galls were found at the south end of the scentless chamomile patch. 2002: In July lots of galls. Site was cultivated, a few winter annual plant in the fall, no galls. 2003: Dense vegetation, hard to find galls, photo of scentless chamomile around a telephone pole. 2003 P - 007. GPS1 WP005.

RM 153	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 15-17-2 W2	20-Aug-01	9			
SK-01-R-034					
Contact Person:	Ernest Briggs	Phone #:	735-2936	GPS: 50.4296	102.2005 Cal

Comments: Landowner: Chacachas.

RM 157	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 28-18-14 W2	23-Aug-01	9	2002	Yes	10
SK-01-R-028			2003	Yes	10
Contact Person:		Phone #:	GPS:	50.54744	103.87228
Comments: Landowner: Bruce Betteridge 699-2532. Released in a pasture. 2002: Photo 2002 P11 - 025. Good site in a field near meadow brome. 2003: 2003 P1 - 018. GPS1 WP025.					

RM 158	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NW 9-19-17 W2	23-Aug-01	8	2003	No	0
SK-01-R-023					
Contact Person:		Phone #:	GPS:	50.60063	104.31593
Comments: Landowner release in roadside ditch in the NW corner of the quarter section. Very hot, dry when released. Transplants were watered every 7 - 10 days. 2003: Only a few plants by rock pile. GPS2 WP411.					

RM 184 Sakimay	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NW 39-19-05 W2	7-Oct-02	12	*****	*****	*****
SK-02-R-043					
Contact Person:	D. Domres	Phone #: 786-1532	GPS:	50.6903	102.6215 Cal
Comments: Requested by Ken Accoose, 697-283? Landowner: Sakimay Reserve Acquisition. Released at the edge of a small pothole.					

RM 184	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 2 19A-5 W2	2-Oct-02	13	*****	*****	*****
SK-02-R-039					
Contact Person:		Phone #:	GPS:	50.9582	102.581 Cal
Comments: Requested by Bert Septon 696-2974.					

RM 185	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 24-21-8 W2	23-Aug-01	9	2002	No	0
SK-01-R-017					
Contact Person:		Phone #:	GPS:	50.81362	102.98205
Comments: Landowner: RM 185, released on a right-of-way 748-2233. 2002: Plastic bag with scentless chamomile. Photo 2002 P11 - 018. No winter annual plants found. Winter annual plant to the north. GPS1 WP026.					

RM 185	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 19-20-9 W2	23-Aug-01	9	2002	No	0
SK-01-R-022					
Contact Person:		Phone #:	GPS:	50.7307	103.23827
Comments: Landowner: Don Gardiner 335-2925. Edge of crop beside farmyard shelterbelt. 2002: No winter annual plants, nearest 60 ft away, with no galls. GPS1 WP027					

RM 189	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 13-20-21 W2	3-Oct-02	12	*****	*****	*****
SK-02-R-040					
Contact Person:		Phone #:	GPS:	50.6987	104.776 Cal
Comments: Requested by Allan Floyd, 731-3376. Released 400 m along a trail into a forage stand. 2003: Visited June 8, no evidence of new galls.					

RM 217	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 09-23-15 W2	22-Aug-01	9			
SK-01-R-029					

Contact Person: Phone #: GPS: 50.93568 104.03108

Comments: Landowner: Richard and Linda Aspinall 432-4828. All plants have flags beside them. Edge of slough, fairly sheltered and little disturbance in that area. GPS2 WP406.

RM 252	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 27-26-29 W2	23-Aug-01	9			
SK-01-R-015					

Contact Person: Doug Patience Phone #: 638-4967 GPS: 51.2517 105.9598 Cal

Comments: Landowner: Town of Davidson 567-2040. In storage compound.

RM 276	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 12-32-13 W2	4-Oct-02	12	2003	Yes	6
SK-02-R-044					

Contact Person: Phone #: GPS: 51.73064 103.71089

Comments: Requested by Saskatchewan Highways, Brian Janson, 544-5430. Landowner: Barry (David) Bateman, Calgary, AB. Released in a gravel pit that was once used by Saskatchewan Highways and Transportation. 2003: Site photo. 2003 P12 - 022. GPS2 WP429.

RM 276	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NW 34-28-11 W2	22-Aug-01	9			
SK-01-R-019					

Contact Person: Phone #: GPS: 51.4711 103.4806 Cal

Comments: Landowner: Doug and Marian Bonar 272-3334. All plants have wooden stakes beside them. Edge of field and in ditch.

RM 278	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 04-29-16 W2	*****	14	*****	*****	*****
SK-03-R-054					

Contact Person: G. Kreitzer Phone #: 835-2560 GPS: 51.4785 104.2004 Cal

Comments: Released in an old yard.

RM 320	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 13-32-23 W3		9	2000	Yes	10^+
SK-00-R-008			2001	Yes	10^+
			2002	No	0
			2003	No	0

Contact Person: Phone #: GPS: 51.75011 109.11935

Comments: 2000: Galls found in 20 minutes. 2001: Evidence of gall on dead summer annual plants. No rosettes at the release site. The gall midge moved to scentless chamomile plants that were growing on the south bank of a dugout. 2002: No scentless chamomile plants found, grasshopper problem. 2002 P11 - 025. 2003: Water level in dugout was high, flooded last years plants. Photo, site and scentless chamomile nearby. 2003 P4 - 024, 025. GPS1 WP117.

RM 337	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 28-36-14 W2	8-Oct-03	12	*****	*****	*****
SK-02-R-048					
Contact Person:		Phone #:		GPS: 52.1174	103.9337 Cal

Comments: Landowner T. Cawiewell. 2003: Released in a right-of-way by a yard site. Site marked. Release remained at bus stop for an unknown number of days.

RM 339	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 36-34-20 W2	15-Oct-02	12	*****	*****	*****
SK-02-R-049					
Contact Person:		Phone #:		GPS: 51.9647	104.6982 Cal

Comments: landowner: Saskatchewan Wildlife Federation, 692-8812. Released in a shelterbelt. Released 800 ft from east boundary.

RM 339	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 36-34-20 W2	6-Oct-02	12	*****	*****	*****
SK-02-R-038					
Contact Person:		Phone #:		GPS: 51.9683	104.7041

Comments: Landowner: Saskatchewan Wildlife Federation, 692-8812. Released in a shelterbelt, 300 ft west of 1/4 line (west side).

RM 341	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 28-32-26 W2	6-Oct-02	12	*****	*****	*****
SK-02-R-037					
Contact Person:	Russ Deneiko	Phone #:	259-4927	GPS: 51.7718	105.625 Cal

Comments: Requested by Pat Clavelle RM of Viscount, 944-2044.

RM 341	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 27-32-25 W2	23-Aug-01	9			
SK-01-R-032					
Contact Person:		Phone #:		GPS: 51.7682	105.4539 Cal

Comments: Landowner:

RM 341	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 16-32-25 W2	23-Aug-01	9			
SK-01-R-020					
Contact Person:		Phone #:		GPS: 51.7427	105.4893 Cal

Comments: Landowner: Ivan Allin 946-2440

RM 344	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
Saskatoon City	15-May-03	12	*****	*****	*****
SK-03-R-051					
Contact Person:	Garry Bowes	Phone #:	933-7695	GPS: 52.18887	106.66742

Comments: Landowner, Edge Transport, released in a drainage ditch, by an equipment storage area. GPS2 WP407.

RM **344**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
Saskatoon City SK-03-R-052	15-May-03	12	*****	*****	*****
Contact Person:	Garry Bowes	Phone #: 933-7695	GPS:	52.1892	106.66764
Comments: Landowner. Edge Transport, released north of house used for storage, by an equipment storage area. GPS2 WP408.					

RM **344**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
Saskatoon City SK-03-R-053	15-May-03	12	*****	*****	*****
Contact Person:	Garry Bowes	Phone #: 933-7695	GPS:	52.18977	106.6664
Comments: Landowner, Edge Transport, released to the east, in the field behind the storage area. GPS2 WP409.					

RM **351**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 8-36-24 W3	23-Aug-01	9	2002	No	0
SK-01-R-024			2003	No	0
Contact Person:	Estelle Finley	Phone #: 372-4470	GPS:	52.0761	109.3967
Comments: Landowner: Bob Finley 372-4258. Released near a tree belt bordering pasture-crop. 2002: Site in the shelter belt behind the workshop back of the house near the cemetery. Drought, few plants, no galls. 2003: Grasshoppers ate plants in fall. Good late fall and spring rains. GPS1 WP020.					

RM **351**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SW 16-36-24 W3	7-Jul-99	16 - 18	2000	Yes	10^+
SK-99-R-001			2001	Yes	10^+
			2002	Yes	10
			2003	Yes	3
Contact Person:		Phone #:	GPS:	52.08705	109.37956
Comments: 1999: Released near a dugout that was constructed 2 years ago. 2000: Not sure of the release point but galls are present 30 m from the general release area. 2001: No water in dugout/slough. Winter annual plants have galls. Evidence of galls on summer annual scentless chamomile plants. Scentless chamomile plants found in the south west corner of the dugout. 2002: Winter annuals (2), dugout. Photo 2002 P11 - 022, 023, 024. 2003: Plants found on south bank of the dugout. Site, toadflax, gall, gall. 2003 P5 - 001, 002 (toadflax), 003, 004. GPS1 WP074.					

RM **429**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 29-45-20 W2 SK-02-R-047	*****	*****	*****	*****	*****
Contact Person:	Tom Boyle	Phone #: 878-8807	GPS:	52.9104	104.8592 Cal
Comments: Landowner: Don Spratt, 752-3800. Release site is a grassed water-way shoulder adjacent to a slough.					

RM **429**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 29-45-20 W2 SK-02-R-047	*****	*****	*****	*****	*****
Contact Person:	Tom Boyle	Phone #: 878-8807	GPS:	52.9104	104.8592 Cal
Comments: Landowner: Don Spratt, 752-3800. Release site is a grassed water-way shoulder adjacent to a slough.					

RM **436**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 21-44-11 W3	30-Aug-01	9			
SK-01-R-031					
Contact Person:	Gordon & Joan Jackson	Phone #: 246-4881	GPS: 52.8013	107.5294 Cal	
Comments: Landowner: Gordon & Joan Jackson. Released in a pasture.					

RM **456**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 22-48-11 W2	29-Oct-03	5	*****	*****	*****
Lee Release2					
Contact Person:		Phone #:	GPS: *****		
Comments: Landowner Brian Brochu, Arborfield, 769-8940. Released in a pasture.					

RM **487**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 13-50-15 W2	9-Jun-00	9	2000	Yes	10^+
SK-00-R-007			2001	Yes	10^+
			2002	Yes	10^+
Contact Person:		Phone #:	GPS: 53.30836	104.05509	
Comments: 9 transplanted plants were alive. 2002: Release site, close up (2). Photo 2002 P11 - 005, 006, 007. Gall found between grassland and field. Good site to collect. GPS1 WP170.					

RM **487**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
SE 13-50-15 W2	9-Jun-00	6	2000	Yes	10^+
SK-00-R-013			2001	Yes	10^+
			2002	Yes	10^+
Contact Person:		Phone #:	GPS: 53.3063	104.05276	
Comments: On July 20, 2000, 5 transplanted plants alive and 3 died. 2002: Release site, close up (3). Photo 2002 P11 - 001, 002, 003, 004. Difficult to see galls because grasses and forbs are moving in. GPS1 WP050.					

RM **488**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NW 10-52-16 W2	28-Oct-03	4	*****	*****	*****
Lee Release1					
Contact Person:		Phone #:	GPS: *****		
Comments: Released on a right-of-way.					

RM **491**	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls
NE 17-50-25 W2	15-Jun-00	9	2000	Yes	10
SK-00-R-011			2001	Yes	10^+
			2002	Yes	1
Contact Person:		Phone #:	GPS: 53.3206	105.59962	
Comments: Land owner Rod and Linda Sexsmith. 2000: The plants were transplanted by the road and then re-transplanted over by the slough. 6 transplanted plants were alive on September 25, 2000. 2002: Very dense stand of rosette, difficult to find those with galls, GPS1 WP119.					

RM 494	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls	
NE 9-51-4 W3	16-Jun-99	25	2000	Yes	10^+	
SK-99-R-002			2001	Yes	10^+	
			2003	Yes	10^+	
Contact Person:	Phone #:			GPS:	53.39448	106.52107

Comments: Released in a quarter section of land which is infested with scentless chamomile. 10 plants were found in 10 minutes. The farmer plans to clean up the scentless chamomile in the corner of the field. 2001: This site was located on the top of a hill. Many scentless chamomile plants were found in micro sites and some have galls. GPS1 WP006.

RM 494	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls	
SE 34-51-4 W3	13-Jun-00	9	2000	No	0	
SK-00-R-012			2001	Yes	10^+	
			2002	Yes	10^+	
			2003	Yes	10^+	
Contact Person:	Phone #:			GPS:	53.44167	106.50018

Comments: Site was sampled on July 6 and August 9, 2000. No galls were found. The scentless chamomile stand was very dense, 0.8 -1 m tall. On the July sample date 9 plants were found alive, whereas none were found alive on the August sample date. Land owner Lawrence Knivlang. Lots of rosettes in the bottom of the gravel pit. 2002: Plants with galls found on the hill and in the gravel pit, 14 collections made in the fall 0f 2001 and shipped. GPS1 WP073.

RM 561	Release Date	No. of Plants Transplanted	Follow-up Year	Insect Present	# Plants with Galls	
SW 14-57-21 W3	*****	*****	*****	*****	*****	
SK-02-R-045						
Contact Person:	Phone #:			GPS:	53.9216	109.0171 Cal

Comments: Landowner: Calvin Morgenstern, 837-4532. Released at the edge of an alfalfa field.

Table 3. List of Release Sites for Scentless Chamomile Stem Weevils

RM 98	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Samples Collected	% Stems Infested	
NW 24-11-17 W2							
SK-01-M-004							
Contact Person:			Phone #:		GPS:	49.9306	104.19862
Comments: Released near Lang. GPS2 WP401.							

RM 320	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Samples Collected	% Stems Infested	
NE 13-32-23 W3		50		2000	Yes		
SK-00-M-002							
Contact Person:			Phone #:		GPS:	51.75004	109.11931
Comments: 2000: On September 21, sampled 10 shoots; cut and sent to Alec McClay. GPS1 WP118.							

RM 435	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Samples Collected	% Stems Infested	
SE 4-45-10 W3				1999	Yes	0	
SK-98-M-000							
Contact Person:			Phone #:		GPS:	52.84215	107.41682
Comments: 1999: Plant samples (50 stems) were collected for Alec McClay. GPS2 WP400.							

RM 487	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Samples Collected	% Stems Infested	
SE 13-50-15 W2	9-Jun-00	50	20-35	2000	Yes	0	
SK-00-M-001							
Contact Person:			Phone #:		GPS:	53.30777	104.0555
Comments: 2000: Plant samples (50 stems) were collected for Alec McClay on September 28, 2000. GPS1 WP054.							

RM 487	Release Date	Release No.	Flowering Stems #/m^2	Follow-up Year	Samples Collected	% Stems Infested	
SE 13-50-15 W2	11-Jun-01	60	>35				
SK-01-M-003							
Contact Person:			Phone #:		GPS:	53.30781	104.05552
Comments: Landowner: Dennis Hludraniuk 862-5256. GPS2 WP403.							